CROSS COUNTRY EVALUATION OF ENERGY PERFORMANCE CERTIFICATION

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IMPACT

Improving energy performance assessment and certification schemes by tests

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Project description

The background of the IMPACT project, which is conducted in the framework of the Intelligent Energy Europe Programme, is the implementation of the Directive on the Energy Performance of Buildings (EBPD) in 2006. In existing building certification schemes barriers have been reported regarding quality, the communication aspects, the certification of apartment buildings and lack of expert (auditor) capacity. In order to have an impact on the energy consumption of buildings all aspects in the certification process need to be addressed. In order to contribute to tackling these barriers IMPACT has the objective to:

1) Test energy performance certification for existing buildings in practice in 6 country pilots
2) Exchange experiences and success factors
3) Derive recommendations for improvement of tools, certification schemes, training of experts and communication
4) Support the EPBD implementation process in 6 countries
5) Disseminate project results on a National and EU wide scale

The tests are conducted in: Belgium, Denmark, France, Germany, The Netherlands and Spain.

Target groups for IMPACT are:

- National stakeholders responsible for EPBD implementation (ministries, building research institutes, national energy agencies)
- Market actors (experts, building owners, intermediary organisations like real estate agents or municipalities).

The project is divided in work packages with the following main deliverables:

WP1	Test preparation	Overall report on national test approaches
WP2	National tests	National test reports (6) Overall report on national tests
WP3	Evaluation and synthesis	Synthesis report with best-practice approaches and guidelines as basis for dissemination activities
WP4	Dissemination	EU newsletter National newsletters National workshops for implementation stakeholders National workshops for markets actors

Project partners

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Tribu-energie France	
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Executive Summary

Since the 4th January 2003 the Energy Performance of Buildings Directive (EPBD) 2002/91/EC entered into force. Three years later was the official deadline Member States had to transpose the Directive into national law. Energy certification of buildings (art. 7) is one of the main requirements with the aim to enhance the energy performance of buildings.

The IMPACT project started in 2005 in the framework of the Intelligent Energy Europe Programme. The IMPACT project aims to support national actors with the implementation of the directive and to contribute to the preparation of market actors for the introduction of energy labelling. For an effective implementation of energy labelling, aspects like quality control, tools and communication need to be prepared thoroughly and tested. Within IMPACT energy performance certification for existing buildings is tested in practice in 6 countries: Belgium, Denmark, France, Germany, Spain and the Netherlands.

The main outcomes of the national IMPACT tests, each with a different focus, are summarised in Table A. Based on these outcomes a good practice model is developed for energy certification throughout Europe. This model is composed of a set of good practice guidelines that cover the essential process steps for energy performance certification. These guidelines are presented by answering 10 of the main questions identified on energy performance certification of buildings. They are based on the status of national implementation of the EPBD as it developed in each individual Member State represented in the consortium, during the course of the IMPACT action.

The guidelines presented are intended to constitute a non-exhaustive list of options which may be taken into consideration by national implementing bodies, their advisors and/or executive representatives. They may act as reference information in a time of changing legislation and support the revision/review of national implementation plans. Any singular option must be considered in the framework of the prevailing national legislative, regulative and market context at the time of consideration. No legal consequences can be linked to references made to national legislation which has come into force, is foreseen, under preparation or not yet in force.

This report is based on discussions in the project consortium as well as on the 6 national test reports and a cross-country compilation report which can be downloaded from the IMPACT site: www.e-impact.org. More in-depth information can be found in these reports.

For an optimal approach for success in a specific country depends on the national context. All approaches have their advantages and disadvantages, which are thoroughly described in the report.

Table A: Main outcomes of national IMPACT tests

Quality aspect/process step	Outcomes	Countries
Expert capacity/ overall process Expert quality/ overall process	Health and safety inspectors, (master) craftsmen and chimney sweepers can successfully issue certificates for residential buildings.. Preconditions for success are: use of a simplified method and training in both energy certification and energy savings in buildings.	France, Germany
Accurate and effective calculation method/ calculation Efficiency, required time and cost / overall process Understanding of end-users / certificate and presentation	For apartments a specific approach is developed. The calculation and recommendations concern the entire apartment block. The entire building and each individual apartment all have the same energy label (based on asset rating). The certificate describes the overall building on 6-8 pages and additional one page with specific information of the apartment transferred. The mentioned energy consumption is based on the measured (operational) climate-corrected heating consumption of the whole building. For the individual apartment certificates this consumption is divided by the total building area and multiplied by the area of the apartment.	Denmark
Accurate and effective calculation method / calculation	A complex calculation method based on building simulation generates a high workload, requires specialists and is sensitive to mistakes.	Spain
Efficiency, required time and cost / overall process	Split the tailored energy advice from the more standard recommendations on the certificates. This can also help in help in addressing the different interests of seller and buyer of a home with the appropriate information.	The Netherlands
Efficiency, required time and cost / building inspection	End-users can be involved in the preparation of the building inspection for the collection of general building characteristics and drawings of the construction.	The Netherlands
Understanding of end-users / certificate and presentation	The label based on classes were far more appreciated in Belgium, while in Germany the coloured band strip was slightly more accepted. This was particularly true for housing associations.	Belgium, Germany
Acceptance of end-users / certificate and presentation	Important criteria for acceptance of the certificate are: - Clear content and layout - Officially approved document - Good performance experts - Limited cost - Picture of the building Personal presentation / elucidation is highly appreciated	Belgium, Denmark, France, Germany, the Netherlands

Guidelines for good practice in energy certification

1. Is there sufficient expert capacity?

First, it is essential to determine if there are enough experts available to issue the annual demand of energy certificates. The number of necessary certificates can be used as a rough estimate. In addition, it has to be taken into account that in the initial period the demand for certificates is high and after a few years the amount will decrease to an average yearly demand. This average annual demand depends on the validity term of the issued certificates. For example, in all IMPACT countries except Denmark the validity term will be 10 years.

2. How to overcome the national expert capacity problem?

There are several ways to overcome the national expert capacity problem.

1. Extension of tasks of experts, who already pay visits to buildings regularly. For example, health or safety inspectors, craftsmen and chimney sweepers. Preconditions for success are use of a simplified method and additional training for these people in energy certification and energy savings in buildings.
2. Phased implementation of energy certification. This diminishes the pressure for the need of many experts on short term, and fits more the average yearly demand in the end.
3. An additional option for countries with few energy experts is training for trainers, e.g. people who recently have followed a training are thereupon used to train new experts.

3. How can expert quality be guaranteed?

There are several solutions to guarantee the quality of the expert. One way is to establish a national accreditation system run by an independent organisation, which is responsible for accreditation and control. Another possibility is qualification requirements for experts in legislation, however without a national organisation in place, which controls this accreditation.

To become an accredited or qualified expert, several requirements have to be fulfilled. There are two main approaches found in IMPACT:

1. Minimal education on energy and building physics and key courses/training, and/or pass an exam. In most cases this level consists of a final degree in architecture, engineering or building physics. Practical experience can be used as trade off for the key course and/or the passing of the exam.
2. No minimal education on energy and building physics, but a guarantee through the quality of the exam. In addition, key course/training has to be attended and the exam has to be passed.

It is also possible to use both approaches in one country. The accreditation can be personal or company based.

Additional measures to guarantee the quality of the expert are:

- Compulsory liability insurance. This can also be a requirement to become or remain accredited. In case of persistent bad performance of an expert his/her insurance can be withdrawn.
- Annual training This can also be a requirement to remain accredited and is also a good opportunity to introduce lessons learned to the experts (feedback mechanism)
- Good access to up-to-date information

4. How can overall process quality be guaranteed?

One important measure to ensure overall process quality is defining (compulsory) clear rules and guidelines for the process. This can be achieved by national standards that give clear instruction and by national regulations and guideline documents.

In addition, overall process quality can be guaranteed through a national accreditation system. An independent organisation is responsible for accreditation and quality control. When a country already has legislation and/or controlling institutes in place for e.g. energy audits, it is interesting to investigate if this structure can also be used for energy certification. This will limit bureaucracy and costs. If countries will not implement a national accreditation system, initiatives for quality assurance should be encouraged on voluntary bases. These initiatives should represent all relevant market actors and can be lead by independent organisations (e.g. energy agencies).

The quality of issued energy certificates can be controlled by:

- Centralized reporting of main results (register e.g. building type, label) as basis for some basic statistic analysis. If addresses are also registered, for example to select addresses for random checks, than privacy legislation may be a limiting factor and should be checked.
- Centralized collection of input data and outcomes in a database for validation. This enables an in-depth analysis and selection of addresses with deviation from average values for input data, energy consumption and/or label. Necessary precondition for these evaluations is a compulsory standardised electronic data system implemented in all software solutions used for certification. Certificates may be checked consequently:
    - in desk research
    - at the building site (inspection)

  During the design phase of the database it is important to take into account that the collected data is also useful for monitoring and evaluating energy certification as a whole.

Subsequently, it is important to translate findings of the checks into improvements of the energy certification process (use feedback mechanisms e.g. like annual training of experts).

Finally, penalties can be used, such as fines, in case of bad performance of the experts. As ultimate consequence, the auditor/audited company may loose its accreditation and/or insurance.

5. How to come to an efficient and cost-effective process?

There are several approaches to limit time consuming activities during the energy certification. National circumstances and specific pre-conditions that need to be met, determine to a large extent if approaches work out favourably.
A non-exhaustive list of possibilities:

- Simplified methods / calculation tools / default values / using reference buildings
- Operational rating, often limited to a specific market segment e.g. non residential buildings and/or old residential buildings
- Handbooks, checklists etc.
- Involve real estate agents or end-users in the preparation of the inspection (data collection of straightforward building characteristics (e.g. type of house, date of construction, number of residents, number of floors and installations, and to provide construction drawing and user manuals for central heating boilers) by the owner/real estate agent)
- Use persons like craftsmen, chimney sweepers, health and safety inspectors, who already regular visit buildings for inspections or other services, for the entire energy certification (the certification may in that case be limited to a specific market segment (e.g. residential buildings).
- Split energy certification from tailored energy advice. Recommendations based on simple decision trees, possible complemented with general advices, on the energy certificate. In addition, a tailored energy advice is offered on voluntary basis. However to reach a substantial part of the market an additional voluntary advice needs to be embedded in national energy policy. For instance, by linking the advice to other instruments as financial support, white certificate system etc.
- Quality embedded in process, this means take care of solutions to assure expert and overall process quality (see questions 3 and 4)

6. How to commit stakeholders and create their awareness? How to create awareness of end-users?

Information campaigns are essential for a proper functioning of the energy certification system in the market. The dissemination of information has to be tailored to the target groups, such as house owners, tenants, housing associations, energy consultants / experts etc.

Additionally, an early involvement of essential market actors in the formation of the national policy concerning the energy certificate systems brings about awareness and commitment for (new) energy certification schemes. At the same time

possible barriers and failures will be recognized and it offers the opportunity for the policymakers to anticipate on these problems at an early stage.

It is recommended to look at national opportunities to link energy labelling to other policy instruments. For instance certain shift of energy labels (e.g. from D to B) can be used as criteria to become eligible for financial support schemes, such as subsidies or low-interest loans for energy saving measures. It is assumed that in this way awareness and commitment to carry out savings in existing buildings can be enforced considerably.

The EPBD holds the obligation that the energy certificate is presented to new habitants/building users, when a building transfer takes place. How the energy certificate should be presented is not prescribed. One possibility is to supplement the certificate by the sale or rent agreement. In this way the end-users are informed on a natural moment which is closely related to the transfer. A preferred option however would be to have an obligation to present the energy label in the sales or rent promotion.

7. What are options for a calculation method with an acceptable accuracy and acceptable costs?

It is recommended to use simplified calculation methods. These calculation methods are characterised by the possibility that standard default values can be used, when detailed data is not easily available. The outcome of the calculation with default values is less accurate than in case building specific data are used. However, by using default values the method may also become less sensitive for erroneous input. It has to be assured that the reliability of the outcome is acceptable. The use of detailed input data should be encouraged by keeping the default values “on-the-safe-side”, leading to slightly higher overall results.

In general, operational rating requires less time and costs than asset rating. So it can be investigated if operational rating is an acceptable alternative for asset rating. Preconditions are that: (1) input data of several heating periods are easy accessible, this depends on the cooperation of building owners; (2) classification per building type is possible (enough building specific data available for benchmarking and similarities within one category). Operational rating limits the scope of recommendations for improvements to standard recommendations. To limit the influence of user behaviour, the operational rating can be limited to large multi-family buildings. To reduce the influence of local climate (relevant especially for countries with different climatic zones) correction factors can be used.

8. What are options to make a certificate understandable?

It is recommended to pay at least attention to the following aspects:

- Avoid misunderstandings on differences between calculated and metered values (energy bills). For example use a label based on asset rating and base the energy consumption displayed on the certificate on metered values in apartment buildings.
- Technical terms used in the certificate, such as primary energy, final energy, CO_2-emissions, need to be explained.
- When end-users are considering taking energy saving measures, they usually need to have additional information. For additional explanations and for initiating follow-up activities easy access to professional information has to be taken care of. For instance, put name, address and telephone number of the expert or of the regional/central info point on the certificate. An option proposed is to add the recommendations for improvements to the certificate as an extra annex document that landlords do not need to present to tenants.

9. What is needed to get the certificate accepted by the end-user?

It is recommended to pay at least attention to the following aspects:

- Clear content and layout
- Official approved document, (mandatory certificate format)
- Good performance experts
- Limited cost
- Customise the certificate by adding a picture of the building
- Personal presentation / elucidation

There is an acceptance obstacle observed by housing associations/companies. They have problems with the displayed recommended energy saving measures, because they fear that tenants use this information for demanding improvements or as argument for not paying the (entire) rent. It is recommended to check the possibilities to diminish this resistance.

10. How to challenge end-users to take energy saving measures?

End-users need insight in the costs and benefits of the energy saving options. In addition, it is important that other possible benefits, for instance improved comfort level, of energy saving measures are closely communicated.

This insight can be indicated on the energy certificate, on additional information sheets added to the certificate and/or a separate tailored energy advice report. It is also of importance that end-users, who seriously consider taking energy saving measures, have easy access to professional information and experts.

Finally, the impact of energy certificates can be enforced by embedding the instrument in the overall policy to incite energy saving in buildings. This can be done by directly using the recommended energy savings and label on the certificate as basis in other policy instruments.

Contents

1 Introduction

Aim and approach

The aim of work package 3 of the IMPACT project is to develop a European good practice model for energy certification throughout Europe. This model is composed of a set of good practice guidelines covering all essential process steps for energy certification.

For this purpose the national energy certifications tests (second part of IMPACT project) are analyzed and evaluated. For this analysis and evaluation the energy certification process in unravelled in several steps. The involved actors in each process step are identified. Furthermore, quality aspects are coupled to the overall process and process steps. For clarification, per quality aspect, the underlying questions which are relevant during the implementation and execution of the energy certification are formulated.

Per quality aspect the outcomes of the various countries are compared and several ways to success are discussed. Where relevant, points of attention are included in this discussion.

It is important to keep in mind that the success of an approach depends strongly on the national context. The outcomes of the evaluation will result in recommendations and guidelines. In addition, good practice examples are highlighted.

Reading guide

The used evaluation method is described in chapter 2. Also a scheme presenting an overview of the certification process, including actors, quality aspects, underlying question is presented in this chapter.

As already stated, the outcomes of the IMPACT field tests are closely related to the national context. In chapter 3 overviews of both the status of energy certification in the IMPACT countries and the specific aim in the national field test are given.

The cross country analysis and evaluation is described in chapter 3. In this chapter per quality aspect the main national characteristics are described. Also the solutions found in IMPACT to the underlying questions, including their pros and cons, are presented.

In chapter 5 the main outcomes and conclusions from the evaluation are formulated. Finally, in the last chapter it is indicated how to come to guidelines for good practice.

2 Evaluation method

To make a structural analysis of the national tests possible, the process of the certification of the energy performance is unravelled.
The certification process consists of five steps: promotion/information, inspection, calculation, reporting and presentation. In second part of the IMPACT-project the results of the national energy certification are reported using this scheme as guideline (format). During this third phase of the IMPACT-project the outcomes of the overall process and each process step are analysed and evaluated. This cross country evaluation is illustrated in Figure 1.

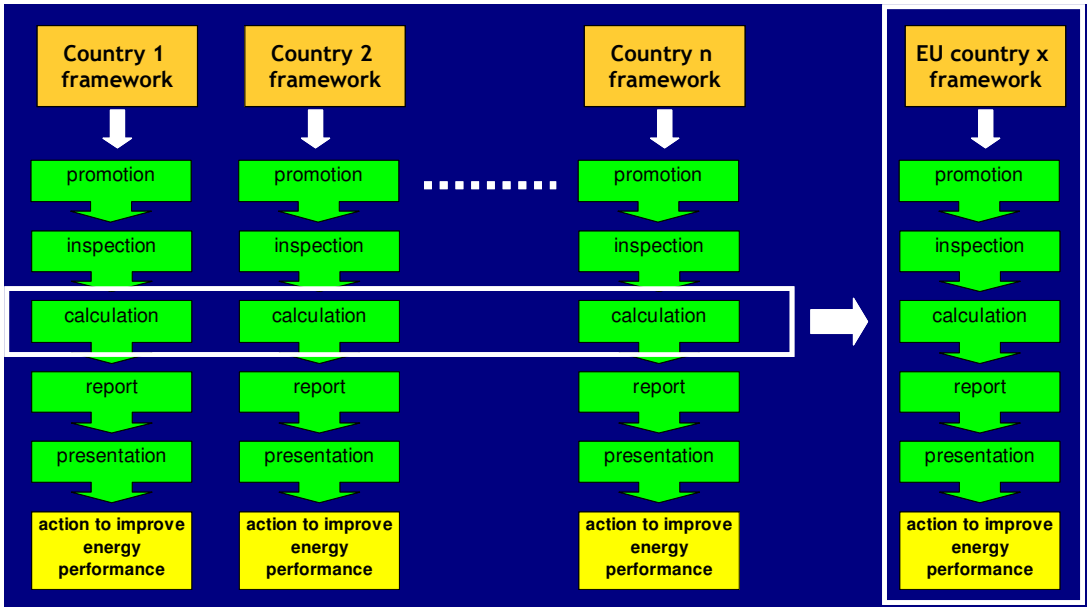


Figure 1 EU certification energy performance EPBD model/guidelines

After unravelling the certification process, the involved actors within each process step are identified and quality aspects (indicators) are coupled to these process steps. However, several quality aspects are playing a role during more process steps. For example, the performance of an expert is important during the building inspection, calculation, reporting and presentation. So, it is decided to start the evaluation with an analysis of quality aspects that determine the overall process quality.

The quality aspects indicate the basis for a successful process (step). For clear communication, the underlying question for each quality aspect is given. These are main questions countries encounter during the implementation and execution of the energy certification.
One has to realise that the approaches for success depend strongly on the national context: what may be good practise in one country may not function in another country. In addition, there may be cross correlations between various quality aspects. For example, in case there is not enough expert capacity, this may directly affect the possible requirements for the quality of the experts. So the evaluation consists of giving insight in several solution paths, including their advantages and disadvantages, per quality aspect.

Figure 2 presents a scheme giving an overview of the certification process, including the actors and the quality aspects. For clarification, also the underlying questions per quality aspect are shown.

In this report a selection of good practice examples from the IMPACT tests are highlighted in separate textboxes. Detailed information on the national tests and the country context can be found in the national test reports.

The chosen approach is related to the theory-based evaluation method. This is a scientific method, which is commonly used for ex-ante and ex-post evaluation to get insight if policies will function as expected. For more background is referred to (Rossi et al, 2004).

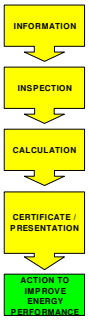
Process	Quality aspect	Corresponding questions
Overall certification process		
	Capacity experts	Is there sufficient expert capacity? If no: How to overcome the national expert capacity problem?
	Quality of expert	How can expert quality and independence be quaranteed?
	Overall quality control	How can overall process quality be guaranteed?
	Efficiency, required time/costs	How to come to an efficient and cost-effective process?
Individual process steps		
INFORMATION	Awareness stakeholders and end-users	How to commit stakeholders and create their awareness? How to create awareness among end-users?
	Coverage of targeted buildings	
INSPECTION	Balance between accuracy and costs of the inspection	What are options for an inspection with an acceptable accuracy and acceptable costs?
CALCULATION	Balance between accuracy and costs of the calculation method (level of detail, asset / operational)	What are options for a calculation method with an acceptable accuracy and acceptable costs?
CERTIFICATE / PRESENTATION	Understanding end-users	What are options to make a certificate understandable?
	Acceptance end-users	What is needed to get the certificates accepted by end-users?
	Creating incentive for action	How to challenge end-users to take energy saving measures?
ACTION TO IMPROVE ENERGY PERFORMANCE	Measures actually taken	Can we monitor the impact of energy certification on energy savings?

Figure 2 Energy performance certification (EPBD) evaluation scheme

3 Overview national contexts

An understanding of the current national status of energy performance certification, the specific country context (like previous experiences) and the underlying research questions of the IMPACT tests are needed during the evaluation to value the outcomes in a proper way. That is why insight is provided in the next two paragraphs.

3.1 Overview status certification (EPBD)

To place the national IMPACT tests and their outcomes in perspective, it is important to be aware of the current status and previous experiences of energy certification. An overview is presented in Table 1.

Table 1 Status legal implementation of EPBD energy certification (October 2006) and specific country context.

Country	Status energy certification (October 2006)
Belgium	Flemish region: A specific law regulates the energy certificates for new buildings. The first certificates will be produced in 2006. For public buildings the energy certificate will be based on operational rating. The certificate will be introduced in public buildings in 2008. Walloon region and Brussels region: The legal context implementing the EPBD is under discussion. The details related to energy certification in general are not yet available. An option considered for the certification process of the existing residential buildings is the conversion of the existing Energy Advice Procedure (EAP), which is currently applied in the whole country on a voluntary basis.
Denmark	Mandatory energy labelling schemes existed since 1997. In these schemes only 20-25% of flats sold had a certificate, because it was perceived as not attractive, too expensive and not reliable. There were no penalties if no certificate was issued for the sales transaction. In 2005 a new Act concerning the Danish labelling schemes adapt the EPBD requirement into legislation. Including a new approach for the certification of flats. The new labelling scheme in Denmark got a postponement until September 2006, because a delay of the development of the electronic tools.
France	The energy certificate has become mandatory in France in October 2006 for existing buildings for sale and from mid-2007 for existing buildings for rent and for all new buildings. This legislation urges the need for sufficient expert capacity able to provide 2 million certificates yearly as from mid-2007.

Country	Status energy certification (October 2006)
Germany	Through the Energy Conservation Ordinance of 2002 energy certificates (without a label) are already mandatory for new buildings. For existing buildings 33 different regional voluntary schemes existed. This has urged the need for a uniform nationally accepted energy performance certificate. The Energy Conservation Law had to be amended to fulfil all requirements of the EPBD, such as making energy certification mandatory for existing buildings as well. This law came into force on September 8th 2005. The draft of the Energy Conservation Ordinance amendment 2007 is currently undergoing the final discussion in the legal implementation procedure. The draft version of the amendment has been published on November 16th 2006.
Spain	Till now the implementation of the building certification is not effectuated. At the moment a draft version of a royal decree exists. This decree concerns only certification of new buildings. The draft was sent at the end of 2005 to the ministry for approval and publication. When the publication will take place is not known. The certification for existing buildings is postponed until then. Also the related and proposed official software tools (CALANER-VYP and CALENER) for certification are not officially published yet.
The Netherlands	In The Netherlands energy performance requirements for new buildings based on an integral calculation methodology have been part of the building code since 1995. Since 2000 for existing dwellings the voluntary Energy Performance Advice (EPA) exists for existing dwellings. The method for new buildings already complies with the EPBD requirements. For existing dwellings the EPA methodology is currently being simplified and a certificate is developed. Transposition into legislation is planned for January 1, 2007.

It appears there are considerable differences between European countries in the status of implementation process of the energy certification requirements of the EPBD into their national legislation. This is not surprising, because some countries had already energy certificates/labels or energy performance standards in place for a certain share of the building stock. Without doubt the Danish legislation in the context of energy certification of buildings is the most advanced. Subsequently, Germany and the Netherlands have already since the midst nineties energy performance standards (and certificates) for new buildings. In the other countries the energy certificate concept is completely new. This means that two categories can be distinguished:

1. Countries which have to ***embed*** an energy performance certification system into their existing national legislation on buildings or amend the existing schemes to fulfil all requirements of the EPBD.
2. Countries which have to ***introduce*** new energy performance standards and an energy performance certification system into their national legislation.

Within the IMPACT project, Denmark, Germany and the Netherlands belong to the first category, and Belgium, France and Spain to the second category. This of course influences the content and outcomes of the IMPACT tests carried out.

In the end, the national context determines which approaches for good practice are useful for a country and which are not.

3.2 Overview IMPACT tests

As already stated in the previous paragraph, the focus of the field tests depended strongly on the national context, specific needs and the status of implementation of energy certification. Overviews, in which the aim and the research questions of the IMPACT tests and the type and number of buildings studied, are respectively presented in Table 2 and Table 3.

Table 2 Aims of IMPACT tests, including underlying research questions

Country	Aims of national tests
Belgium	Aim is to find out advantages and disadvantages of the Energy Advice Procedure (EAP) application as a certification tool for existing dwellings. Recommendations applicable in a more general context and not only to the EAP have been derived. Expert training and the actual method are investigated.
Denmark	Aim is to optimise and test the Danish certification scheme for different types of apartment buildings, making it more attractive, less expensive and more reliable.
France	Aims are: (1) to confirm that the lead-asbestos-termites experts (DI), who have no background knowledge on energy will be among the future experts in order to deliver more than 2 million energy certificates each year (2) to check the advantage of a simplified method (3) to estimate the costs of the issuing certificates (4) to analyse end-users' attitude towards the certificate. Focus was on: training, carrying out tests, analysing and evaluating the outcomes of the tests.
Germany	Aim is to gain insight into optimization of the energy certificate prototype and the precepts of its compilation. In IMPACT a uniform certificate for use at national level was developed and tested. The test for residential buildings focused on testing the label, certificate format, end-user acceptance, qualification of issuers and the simplified methods This was mainly done by end-user and issuer inquires. For the non-residential test the practicability of the new calculation procedure and the acceptance of the displayed certificates were tested. This meant a focus on technical issues such as calculation procedure, simplified data collection, calculation of reference values and the handling of operational data.
Spain	Aim is to compare and test two certification tools in 16 different buildings. The Spanish test differs from most other national IMPACT test and is quite technically orientated. The underlying reason was, that at the start of IMPACT, neither experience on energy certification nor a legal framework existed in Spain

Country	Aims of national tests
The Nether-lands	The Dutch government has decided to introduce a simple and concise mandatory energy certificate that can be supplemented on a voluntary base by a more comprehensive tailored advisory report, like the existing tailored Energy Performance Advice (EPA). The aims of the Impact field test were: 1) to assess how home owners appreciate a draft energy certificate, its potential effect on the implementation of energy-saving measures by the home owners and the possible role of home owners in the assessment procedure; 2) examine the performance of an updated version of the EPA software and assess the time required for EPA advisors to complete the various components of the assessment process.

Table 3 Number of studied dwellings and buildings in IMPACT tests

Country	Residential		Non-residential
	Single-family	Multi-family	
Belgium	20 Sensitivity analysis study on 132 dwellings		
Denmark		240 flats (6 buildings)	
France	102	70	
Germany	1374 (one and two-family buildings)	2551 buildings	38 buildings
Spain		221 apartments (10 buildings)	5 buildings
The Nether-lands	94 12 detached, 15 semi-detached, 67 row houses		

4 Evaluation of energy certification

In this chapter each quality aspect of the energy performance certification is discussed. First, the aspects, which refer to the overall process, are described. This concerns the national expert capacity, the quality and the efficiency of the overall process. Underlying questions are:

- Are there enough experts to issue the required numbers of certificates with appropriate quality?
- How is the quality of the energy certification process assured? and
- How is an efficient and cost-effective procedure arranged?

Subsequently, the quality aspects per process step are discussed. When there is an overlap with quality aspects regarding the overall process this is reported.

The analysis and evaluation of each quality aspect consists of:

- The description of national characteristics, including the comparison between countries. This means that the main similarities and differences are reported.
- The possible solutions, including their advantages and disadvantages, to the main problems (questions) countries encounter during the implementation and execution of energy certification.
- The highlighting of good practice examples from the IMPACT tests in separate textboxes.

4.1 National capacity of experts

Experts are needed to perform building inspections and to process and issue energy certificates. So an initial requirement for a proper functioning of an energy certificate scheme is the availability of enough expert capacity for issuing certificates.

4.1.1 National characteristics

The number of certificates needed, can be used to roughly estimate the necessary expert capacity. In the first year after implementation there will be a high demand for certificates, because none of the transferred houses has an energy certificate. Later on, the amount will be decreasing to an average yearly demand. Most countries anticipate on this situation by planning transition periods (see also paragraph 4.1.2, on phased implementation). The average annual demand depends on the validity term of the issued certificates. In all IMPACT countries, ex-

cept Denmark, the validity term will be 10 years. Denmark will limit the validity to 5 years.
An overview of the available capacity, as well as the needed capacity, in IMPACT countries is presented in Table 4.

Table 4 Estimated number of certificates needed per year and necessary and available experts for certification (fte = full time units)

Country	**Number of certificates needed (transferred dwellings per year)**	**Needed capacity**	**Available capacity**
Belgium	325.300	1340 experts	Not available. All the requirements about experts have not been defined yet. Planning is gradual implementation
Denmark	110.000	1200 certified active experts	Approx. 1000 certified active experts
France	2.200.000	6000 experts (full time units)	Foreseen 6000 lead-asbestos and termites experts in 2007 and these experts will be trained to enable them to issue energy performance certificates
Germany	< 500,000	Approx.. 5,500, number of issuers based on asset rating procedure	dependent on legal qualification requirements.
Spain	1.000.000[1]	2245 (fte), for new buildings it is estimated around 870 (fte) and for existing buildings around 1375 (fte)	
The Netherlands	500.000	1000 full time units (for both residential and non-residential)	200 full time units

[1] New and existing dwellings, certification will be done on building level (proposed in the Certification draft decree of October 2005)

Only in Denmark no capacity problem occurs. In the other five countries the demand for experts exceeds the available experts, so there a capacity problem is observed.

4.1.2 How to overcome the expert capacity problem?

Several solutions are in place to overcome the expert capacity problem. France and Germany extend the tasks of persons, who already carry out regular building inspections. In France, it concerns the lead-asbestos-termites specialists. In Germany, for example, interior designers and chimney sweepers may issue certificates for residential buildings. In countries, where the introduction is completely new (Belgium, France and Spain), the energy certification is gradually made compulsory. This diminishes the pressure for the need of many experts on short term, and fits more the average yearly demand in the end. The approaches and their pros and cons are shown in Table 5.

Table 5 Found solutions in IMPACT countries, in case there is not sufficient expert capacity

Solutions *in case there is not sufficient expert capacity*	**Pros**	**Cons**
Option to build large expert pool in short time: extension of tasks of experts, which already visit buildings regularly. For example health or safety inspectors, master-craftsmen, technicians in the building sector, interior-designers.	- efficient approach - limited costs	- persons with no specific background on energy demand and saving measures, this means attention has to be paid to their training. Especially to be able to give recommendations for energy savings. (see also table 7)
Phased implementation (e.g. first old buildings; different methods, eg 1st operational)	- practical learned lessons from previous implementation phase can be used for next phase - it can be used in combination with market approach focused on specific category of buildings	- slow implementation rate, delay of energy saving measures
Option for countries with few energy experts: training for trainers, e.g. people who recently have followed a training are thereupon used to train new experts. This happens in practice in Spain and partly in Belgium.	- in short time more educated persons	- possible not an optimal knowledge transfer - trainers with little practical experience

The French IMPACT test is explained in detail in the separate textbox. From the German IMPACT test it appears that by the end-users certificates of master craftsmen are as well accepted as certificates issued by energy experts.

Lead-Asbestos-Termites (LAT) Experts for energy certification in France

In France, from July 1st 2007 more than 2 million energy certificates need to be delivered yearly for dwellings. There are not enough energy experts available to issue so many certificates. To solve this capacity problem, it was decided to use lead-asbestos-termites (LAT) experts that already do building inspections as part of the sales process of a building. In the IMPACT project it was tested: If these LAT-experts were able to issue the energy certificate? This was one of the main questions of the Ministry of Housing.

The LAT-experts are in place since 1996 when it became mandatory to have a diagnosis concerning asbestos in buildings. This implies that building inspections are already carried out by these experts on regular basis.

Because these experts are not specialized in the energy field, they were trained and the calculation method and tool were simplified (using less than 50 input data). It appeared that under these circumstances the LAT-experts were perfectly able to issue energy certificates. This was proved by controlling their certificates afterwards.

However, during the IMPACT test it was also observed that the experts had problems with the assembly of a tailored building energy advice. Currently, additional steps, such as training, are taken to overcome this barrier.

[Reference: IMPACT/22-23/2006/WP2.3]

4.2 Quality of the overall process

Two elements can be distinguished in the quality of the overall procedure:

1. How is the work been carried out? This regards for a large extent to the quality of the performance of the people carrying out the inspections, calculations, reporting and explanation of the certificate and/or energy advice.
2. How is taken care of the proper functioning of the process? This concerns the quality control of the overall process and a clear structural method for inspection and calculation.

4.2.1 Quality of experts

4.2.1.1 National characteristics

For the proper functioning, credibility and the acceptance of the energy certificate scheme, it has to be guaranteed that issued energy certificates provide reliable information. The quality of energy certificates and energy advices are to a large extent determined by the performance of the experts. To guarantee a good performance most countries studied have set requirements for experts. An overview of the (planned) profile of the experts in the countries is given in Table 6. The

preconditions vary in the countries studied. In Belgium and Spain the requirements for experts are still under development. In Germany and the Netherlands, the proposed requirements are pending for further endorsement.

Most countries researched have a national accreditation system in place or planned to assure a good performance of the experts. The accreditation can be personal or company based. In Denmark and in France the expert has to be nationally accredited. In the Netherlands the national accreditation will be given to the company. This means that at least one person within a company has the accreditation and he/she is responsible for the issued energy certificates and advices carried out by his/her colleagues. In Germany qualifications for certification of existing buildings are clearly defined in the national Ordinance, qualification requirements for the certification for new buildings remain in the jurisdiction of the Federal States.

To become accredited several requirements have to be fulfilled. For example, a minimal education level in the field of energy related to buildings. In most cases this level consists of a final degree in architecture, engineering or building physics. Also in most countries an additional training/course in the field of energy certification is mandatory to become accredited as energy expert. In addition, it can be compulsory to pass an exam (Denmark, France). The German approach is more flexible, practical experience or the full authorization for submission of building specifications can replace the requirement of additional training courses. In Denmark practical experience is an additional requirement.
In Germany also master craftsmen and technicians in the building field, are allowed to issue certificates for existing residential buildings if they attend a sufficient training course. The German IMPACT results show that the craftsmen were well accepted by end-users. It can be interesting for other countries to adopt this flexible approach of Germany
In France, there are no specific requirements to enter the training. However, the level of the exam itself assures that the knowledge level on energy performance of buildings is sufficient. In practice, the majority of experts will be persons with a relatively high education level, because it concerns the lead-asbestos and termites experts.

In all countries studied with a national accreditation the experts/auditing companies may loose their accreditation if they do not comply with the standards and/or have low quality performance. In all countries the experts are responsible for the correctness of the data in the certificate and/or energy advice even if the data assessment is performed by another person (e.g. owner).
Another aspect is that in most countries it is obliged that the accredited expert or company has a professional liability assurance. Also it can be required that the expert has to follow an annual update course.

Besides requirements for accreditation, good access to up-to-date information is essential for good performance of experts.

Table 6 Overview requirements education, background level of experts, which may issue energy certificates and/or give energy advice

Country	Specific area or building segment	(planned) Profile of the experts
Belgium	Flemish region: certification new buildings	Architect, engineer architect, civil engineer or industrial engineer. Probably additional training will be obligatory
	Flemish region: voluntary energy advice of existing residential buildings	Any person having a degree of the secondary school, and additionally trained
	Walloon region	Government determines requirements for energy experts. Probably only building professionals and additional training will be obligatory
	Brussels region, Existing buildings	Persons recognised by the Region
Denmark	Energy consultant	Trained engineer, architect, construction designer or similar level. Consultants must have a compulsory professional liability insurance, which must be kept in force at least 5 years after the last certification, further they are obliged to participate on the admission course for the Energy Certification Scheme and must have passed the test. There are two kind of consultants – one for small dwellings and one for the rest of the buildings. The required education is different for the two consultants types.
France		Every expert will need a certificate in July 2007 to be allowed to carry out its profession. The accreditation deals with: a written exam, an on-site exam, the control of 2 certificates delivered each year. The accreditation of the expert lasts 5 years. No former training or education level is required to register to the exam, but a good level of knowledge will be needed to pass the exams
Germany	Existing buildings	Current EnEV draft (November 16th 2006): Persons with a final degree in architecture, structural/civil engineering, building services, building physics, mechanical electrical engineering For residential buildings only: Interior designer, master craftsmen in the field of main construction crafts, hearing, installation, chimney sweepers, accredited technicians in structural engineering, building services Additional requirements are: - key courses in energy efficient building **or** - two years of practical experience (buildings or building systems) **or** - additional training according to requirements in annex of EnEV **or** certificate for construction project applications
	New buildings	Qualification of issuers remain in the jurisdiction of the Federal States

Country	Specific area or building segment	(planned) Profile of the experts
Spain		Undecided From the gained experience of the IMPACT project it can be concluded that a higher technical education of university degree (engineering, architectural) with considerable additional training is needed to use the LIDER/CALENER tool. For the use of the EPA ED tool, no high university degree is needed, although some training would be useful.
The Neth-erlands	Existing buildings	○ Higher vocational education (HBO) in the fields of civil, mechanical or electrical engineering, or an intermediate vocational education (MBO+) in the same fields with additional training on building physics or installation engineering. ○ Additional training for experts given by one of the recognised training centres. ○ Several years' experience in the field of energy conservation techniques (knowledge of matters relating to comfort and indoor environment is a must). ○ The expert must also have advice skills (communication, anticipate on the wishes of the client).

How can expert quality be guaranteed?

An overview of the options to guarantee expert quality in the countries studied including their advantages and their disadvantages is presented in Table 7.

Table 7 How to guarantee expert quality? Possible solutions, including their advantages and disadvantages.

Solutions		Pros	Cons
Possible ways to organise expert quality guarantee			
National Accreditation, this includes an independent organisation, which is responsible for accreditation and control	accredited person	quality is assured in a direct way	- government and/or company has the risk of losing investments when persons switch from jobs - highest costs
	accredited organisation	- less dependent of personal career choices - continuation of work guaranteed - lower costs than personal accredition	- more attention has to be paid to the quality control of the performance of persons, who are carrying out energy certification and advices - higher cost than only qualification requirements and no independent organisation
Qualification requirements for experts in legislation, but no official national organisation which controls this legislation		- it can be efficient, for instance in case it is connected to other accreditation systems already in place - low costs	- no centralized control of the quality of experts
Possible requirements to become an accredited or qualified expert. Two main approaches are found within the researched countries of IMPACT. It is also possible to use both approaches in one country (e.g. Germany)			
Minimal education on energy and building physics and key courses /training, and/or pass the exam. Practical experience can be used as trade off for the required minimal education level.		high knowledge quality is assured in a direct manner	- capacity problem in case there are too few specialists - possible conflict of interest between advise and follow-up activities - awareness about new developments in the field of energy certification not assured, attention has to be paid to annual traing and/or good access to up-to-date information
No minimal education on energy and building physics, but guarantee through quality of the exam. In addition key course/training has to be attended and the exam has to be passed.		more capacity for experts becomes available, e.g. use of craftsmen, health and safety inspectors	- less specialized knowledge on energy performance in buildings. From the French and German field test it appears that craftsmen, health and safety inspectors can succesfully issue energy certificates, but have problems to recommend energy savings. This problem is recognized, and currently authorities are looking for improvements of the situation. - awareness about new developments in the field of energy certification not assured, attention has to be paid to annual training and/or good access to up-to date information
Possible additional measures			

The possible solutions to successfully guarantee expert quality depend on the national context. The available national capacity of experts, who are specialised in energy savings in buildings, is an example of this dependency. In case there is enough capacity, the accreditation may be based on high education levels on energy and buildings physics (architects and building physics engineers).
In case countries are facing a capacity problem, it is interesting to investigate if it is possible to extend tasks of experts, who already visit buildings regularly. For example: health or safety inspectors. The French field test proves that these

types of inspectors can successfully issue energy certificates when provided with adequate tools and training. Also master craftsmen and chimney sweepers, can perform in the tasks of energy certification of residential buildings. This proposition is successfully tested in Germany.

In Denmark experts have to attend an annual course to remain accredited. This precondition may be interesting for other countries as well.
This also allows for a feed-back loop; e.g. feed-back the learning's from the monitoring of developing schemes back to the experts (see also the next paragraph and Table 8).

4.2.2 Quality control of overall procedure

4.2.2.1 National characteristics

As already mentioned in the previous paragraph most countries studied plan or have a national accreditation system in place. An independent organisation is responsible for accreditation and quality control. In Germany qualification of issuers for existing buildings is defined as educational preconditions in the Ordinance without national accreditation.

Most countries centrally register the main results of the certificate (label and address). These data are subsequently used for random checks either by desk or on site research. Several countries (Denmark, Germany, and Belgium (planned)) have a central database in which all outcomes of the energy certificate and/or advices are collected. In Germany the database is hosted by dena on a voluntary basis, not in terms of a compulsory national database. As a result, detailed information on the certified buildings becomes available. This information can be used for structural monitoring, evaluation and control. In course of time, it can provide insight in the impact of the energy certificate scheme.

Denmark and the Netherlands have reported that they use the findings of the random checks and structural validation to improve the energy certificate scheme. For instance in the Dutch test a problem occurred with the new approach to compose sets of energy-saving measures. This new option in the software is developed, so that the software can guide the advisors in proposing two sets of recommended measures: a 'sufficient' and an 'optimal' set, based on specific energy index requirements. Deviations are allowed if the advisor provides a reason for doing so. The objective of introducing this change in the software was to achieve greater comparability and consistency in the composition of the sets of measures recommended by different EPA advisors. However, it appeared that it did not automatically improve consistency across advisors. Based on these test results it is recommended that the software and the manual for advisors should offer clear instructions for the process of composing sets of measures.

Almost all countries studied use a simplified method for collecting input data during inspection. In addition, handbooks are made to take care of a good explanation towards experts.

Finally, most countries use a repressive measure such as penalties in case of bad performance of the experts. As ultimate consequence, the auditor/audited company may loose its accreditation and/or insurance.

An elaborate quality control system in Denmark

On behalf of a national secretariat, quality assessment in Denmark will be managed by a union of independent private companies.

The quality assessment scheme consists of the following elements:

- Each certificate must be registered to a central database and gets a unique number
- Automatic screening upon registration (select reports that deviate from the average)
- General control (statistical analysis of tendencies and patterns in the scheme)
- Visual control - desk report control (review of reports, handbook compliancy check)
- Field control (field inspection of completed certificates)
- Registry and analysis of consumer complaints

[Reference: IMPACT/25-26/2006/WP2.4]

4.2.2.2 How can overall process quality be guaranteed?

An overview of the options to guarantee overall process quality in the countries studied including their advantages and their disadvantages is presented in Table 8.

Table 8 How can overall process quality be guaranteed? Possible solutions, including their advantages and disadvantages.

	Solutions	Pros	Cons
	Clear rules and guidelines for the process. Use of uniform, structural, often simplified method in combination with handbooks.	- time and cost savings - less chance on mistakes input data - less experienced people can carry out calculations	
	Independent organization responsible for accreditation and for control, see also national accreditation of experts	- independency of quality control assured	- possible bureaucracy, more time consuming administrative procedures - extra cost
pro-active	Centralized reporting of main results for random checks of energy certification and energy advices.	*in general* : - direct insight of performance of experts - possible to anticipate on bad performance of experts (at an early stage)	*in general:* no optimal response from experts, attention has to be paid to assure that information is provided by experts. From the field test several ways are observed: reports can only by printed in case the information is handed over (Belgium), coupling to certification number (the Netherlands) In case adresses are registered mind privacy legislation.
pro-active	Centralized collection of input data and outcomes in a database for valida-tion. This enables an in-depth analysis and selection of addresses with deviation from average values for input data, energy consumption and/or label. Certificates may be checked consequently: - in desk research - at the building site (inspection)	- structural insight in performance of experts - insight if aimed at market segments are actual reached - insight in impact of the energy certification - insight over a longer period, time series, see if there are improvements in course of time - possible to adjust policy, or to take additional actions at an early stage *From desk* : more buildings can be checked within the same period, little costs *From inspection* : actual situation is checked	*in general* : no optimal response from experts, attention has to be paid to assure that information is provided by experts. - time consuming - extra cost - possible problems with security privacy data *From desk* : not checked if report represents the practice correctly *From inspection* : higher costs, more work load
pro-active	Translate findings of these checks in improvements (feedback mechanisms)	- interactive continuously improved system - more effective system, more impact	- market needs to be continuously informed - can lead to misunderstandings, too many changes will not be accepted
repressive	Penalty; loss of accreditation; loss of insurance in case of bad performance of an expert	- guarantee that experts with an bad performance are barred from the market - source of income	- enforcement may be time consuming and lead to extra costs

One important measure to ensure overall process quality is defining (compulsory) clear rules and guidelines for the process. This can be done by national standards that give clear instructions and by national regulations and guideline documents.

In almost all countries studied attention is paid to quality control of the overall process. In Spain, it is not yet clear how quality will be controlled and guaranteed. Solutions vary from a complete structural validation system (Denmark) to collection of the main results in combination of random check of ups and downs results. A central database with all outcomes of certificate gives good insight of performance of the experts. However, some problems may occur regarding security of data privacy when person-related data ought to be collected. In addition, after being a couple of years in operation, data can be used to estimate the impact of the

instrument and for instance recommendations to adjust policies. On the other hand, it might lead to bureaucracy and high costs. So it is important to look after a good balance of investments in such a database and its contribution to a well performing energy certification process.
Besides improvements on individual expert performance it is important to see if the results from random checks indicate the need for more structural changes in the process. At the moment two countries (Denmark, the Netherlands) report this type of feedback mechanism; perhaps this instrument is useful for other countries as well.

4.3 Efficiency of overall procedure

4.3.1 National characteristics

Another important quality aspect is the efficiency of the process. Within IMPACT all countries evaluated the time efforts for the procedure. An overview of the needed time and the cost for certification is presented in Table 9. The typical time needed for one building is between a couple of hours to one day. In France, by using the simplified tool, it takes only 2 to 3 hours to issue an energy certificate. The more elaborate procedure in Belgium (in combination with the diverse building stock) leads to higher numbers up to 16 hours for the energy certificate including advice. The results for Germany and the Netherlands end-up with figures somewhere in between.
In Denmark, the time effort represented regards the new approach for apartment blocks. Energy certification for the whole building requires 11 to 16 hours. This results in an average time per apartment of 0.3 hours.
The tests in Germany and Spain for non-residential buildings indicate that certification of these building types in combination with complex or new software tools lead to a more time consuming procedure. Both state a necessary effort of up to 50 hours for the full certification scheme.

The tests of Belgium, Germany and the Netherlands also looked into detail how much time is required for single tasks. It is found that most time-consuming aspects are:

- measuring the building (all three countries), specific determination of surface area and thermal specifications (Germany),
- data-input in software (Belgium and the Netherlands),
- travelling (the Netherlands) and
- personal presentation of advice to the end-user (Germany and Belgium).

Within IMPACT also the costs for energy certification are studied. The outcomes are included in Table 9. Typical costs for one energy certificate including some recommendations are 100 to 400 euro.

In addition, the market surveys in Belgium, France and the Netherlands included questions about how much the end-users are willing to pay for a certificate. According to the Belgian survey 85% of the persons are not willing to pay more than 200 euro, and 60% would spend less than 100 euro. In France most users do not want to pay more than 100-150 euro per energy certificate. The majority (74%) of the Dutch end-users do not want to pay more than 100 euro per energy certificate.

Table 9 Time and cost to issue an energy certificate and/or an energy advice (be aware that there are differences in building types and level of recommendations per country)

Country	Time	Costs
Belgium	4 to 16 hours, (to deliver a complete advice), in general less than 12 hours	250 to 500 euro, 75% of the executed audits of which 40% was subsidised
Denmark	11 to 16 hours, for the whole building, per apartment 0.3 hours	Approximately 400 euro depending on the area of the building, a maximum price for certification is legally defined for buildings smaller than 500 m^2. For larger buildings the market price is free.
France	2 to 3 hours	150 to 200 euro
Germany	1 to more than 12 hours, In most cases between 3 and 6 hours	0 to 900 euro, of which 32% were below 200 euro and 65% below 300 euro
Spain	For residential buildings: 10 hours (EPA-ED) – 22 hours (LIDER-CALENER-VYP) Large non-residential buildings: 24 hours (EPA) – around 40 hours (LIDER-CALENER-VYP)	n.a.
The Netherlands	4 to 6 hours	100 euro (fee within IMPACT test)

4.3.2 How to come to an efficient and cost-effective process?

The countries studied tested end proposed to use several approaches to limit time consuming activities during the energy certification. For instance usage of simplified calculation tools or the (partly) use of default input data so that required time for data input is diminished. These options, including their pros and cons, are shown in Table 10.

Table 10 How to come to an efficient and cost-effective process? Possible solutions, including their advantages and disadvantages.

Solutions	Pros	Cons
Use of simplified methods (e.g. default input data) / calculation tools / using reference buildings	- time and cost savings - less chance on mistakes input data - less experienced people can carry out calculations	- less accurate
Use operational rating, often for a specific market segment e.g. non residential buildings and/or old residential buildings	In general: - input data simply available and little time needed - low costs - not so sensitive for mistakes, building geometry and characteristics don't have to be analysed. - directly clear for end-user	- sometimes input data are not simply available, bills are missing or people are not willing to co-operate. This appears from the French test case. - for the labelling system there is a need for differentiation to building categories (benchmark) - behaviour and miscellaneous electric equipment play a role in the outcome, this can influence the issued label, this means the label does not necessarily represents the quality of the building shell and the applied energy systems. In addition, this may confuse the end-user. - it can be difficult to calculate pay-back time of energy saving measures.
Use of handbooks, checklists etc.	- time and cost savings - less chance on mistakes - less experienced people can carry out inspections	
Use real estate agents or end-users themselves to prepare the inspection (building data)	- time and cost savings - create commitment with end-user	- more chance on mistakes. From the field test in the Netherlands, it appears that the general building data (age, drawings etc) can be provided, but surface measurements and specific technical information (boiler type, type of insulation) are too difficult for end-users
Use persons like craftsmen, health and safety inspectors, who already pay regular building visits, for the entire energy certification	- time and cost savings - more capacity becomes available on short term	- more chance on mistakes, so there is a need for appropiate tools, guidelines and handbooks - they will not always be able to give (direct) building specific energy saving recommendations
Split energy certification from energy advise. In this case: - Use standard recommendations on energy certificate, - general advices or - recommendations from simplified calculations - Offer (additional) voluntary more tailored energy advice	*in general* : time and cost savings *standard recommendations* : create awareness of simple actions which can lead to energy savings *voluntary advice* : direct selection of end-users who seriously are interested and willing to take energy saving measures	*standard recommendations* : certain advices may not be technical applicable in the certified building *voluntary advice* : - only limited part of the building stock will be reached. Therefor additional promotion campaigns and link to additional incentives are needed to reach bulk of market
Quality embedded in process, this means take care of solutions to assure expert and overall process quality	- prevent mistakes and bad performance so little corrections afterwards are needed, this will lead to time and cost savings	- possible bureaucracy

All countries studied have simplified methods and/or calculation tools in place or planned to be in place. In most countries handbooks and checklists are developed or already in place. Exceptions are Belgium and Spain, because in these countries the implementation of energy certification is still at an early stage.

In the Dutch field test (see also text box) it is studied if home-owners can contribute to diminish the work load for experts by providing data. This appears to be the case. So it might be interesting for other countries as well to see if buildings-

owners, real-estate agents or tenants can contribute to improvement of the cost-effectiveness of the energy certificate process.

In several IMPACT countries (e.g. Germany and the Netherlands) the tailored energy advice is or can be split from the energy certificate. In Germany a tailored advice needs to given (if possible) but the advice is not part of the legal certificate but an annex to it. In this way landlords can keep the recommendations to their own use and only provide the certificate to the potential tenants. In the Netherlands the voluntary tailored energy advice is a separate instrument not linked to the energy certificate. From an economic point of view this is interesting because this can concentrate the work load for advisors on that share of the market, the buyers of dwellings, which seriously take energy saving measures into consideration (for detailed information is referred to paragraph 4.7 and the textbox below).

The Netherlands splits the extended energy advice from the energy certificate

In the Netherlands, it is considered and tested in IMPACT to split the elaborate tailored energy advice from the energy certificate. The main reason for this decision is to limit cost for implementation of the energy certification scheme.
The energy certificate is based on the outcomes of a certified calculation method. The list of recommended energy saving measures are specific for the building, but they do not take yet all the detail building characteristics (e.g. ventilation channels, material of window frames) into account. As a consequence, it is possible that not all recommendations can be applied in the building concerned.
As a separate instrument building owners can be offered a thorough voluntary tailored energy advice. This split has the advantage that the tailored advice can be directly addressed to the persons who are really considering to take measures. However, from the field test it also appears that people are not willing to pay very much for a tailored energy advice (about 50 Euro). This means that the voluntary energy advices probably need to be linked to other incentives. Currently it is under consideration to link the certificate and the energy advice to other supporting mechanisms for energy saving measures in buildings. Examples of these mechanisms are: subsidy scheme, white certificate system (as in the UK or Italy), include energy saving measures in the rent validation system etc.

Contribution to building inspection by home owners in the Netherlands

The Dutch test shows that time to collect building data can be reduced if home owners contribute to a part of the data collection.
However not all data required can be collected accurately by the home owners. The test showed that the information on surface areas and levels of insulation supplied by the home owners deviated considerably from those assessed by the experts. However, owners were able to supply accurate information on general building characteristics, such as type of house, date of construction, number of residents, number of floors and installations, and to provide construction drawing and user manuals for central heating boilers. Almost 80% of the home owners would be prepared to invest up to two hours of their time to collect data for the building assessment in exchange for a 20% discount of the assessment. These data could be provided on a simplified assessment form, together with construction drawings and user manuals of installations.

[Reference: IMPACT/13-14/2006/WP2.1]

4.4 Information

4.4.1 National characteristics

Until now, most countries are focused on the legal implementation process of energy certification. The organisation of information campaigns comes up in the next phase of the process. Broad promotion campaigns are already planned in Denmark, Germany and the Netherlands after the implementation of the energy certificate system has come into force.

All countries are planning to provide information leaflets or brochures on the topic. Already information is available on several national websites (www.ens.dk , www.zukunft-haus.info, www.femsek.dk , www.energielabelgebouw.nl). In France, Denmark and Germany a national hotline service is in operation.

In Denmark, lessons are learned from the experiences with the existing mandatory certification scheme. In the past, it was assumed that in principle the schemes were mandatory and therefore needed no special promotion. However, the outcome of the coverage of the existing schemes refuted this; the coverage was in average 50 % for all buildings while only approximately 25 % of the flats got a label. The low awareness of the existing schemes was a directly due to lack of public campaigns and advertisement.
In general, national authorities involve stakeholders in the formation of the policy concerning energy certification. In this way the awareness of main stakeholders is assured.

Several countries (Denmark, Germany and the Netherlands) are looking for opportunities to link the energy certificate system (labels) to other policy instruments, such as subsidies for improvement measures. It assumed that in this way awareness and commitment to carry out savings in existing building is enforced considerably.

The EPBD holds the obligation that the energy certificate is presented to new habitants/building users when a building transfer takes place. How the energy certificate should be presented is not prescribed. Several countries think of supplementing the certificate to the sales or rent agreement. In this way the end-users are informed on a natural moment that is closely related to the transfer. From the tests in Germany and France, it appears that housing associations have problems giving insight in possible energy saving recommendations. They expressed their fear that tenants will demand for the recommended modernisations. In addition, tenants are perhaps not willing to approve with an increase in rent in return.

4.4.2 How to commit stakeholders and create their awareness? How to create awareness of end-users?

An overview of the found ways in IMPACT to commit stakeholders and assure awareness of the introduced energy certification scheme is presented in Table 11.

Table 11 How to commit stakeholders and create their awareness? How to create awareness of end-users? Possible solutions, including their advantages and disadvantages.

Actors	Solutions	Pros	Cons
implementation stakeholders	Involvement main stakeholders during the formation of the energy certificate policy as well during implementation of the policy	- create direct commitment - to anticipate in an early stage on possible barriers in the market	- time consuming, possible delay in decision making through intensive discussions
implementation stakeholders	Fines, penalties in case the national legislation about energy certification is not fulfilled	- clear on beforehand that work has to be carried out and the quality has to be good - source of income	- negative starting point, can discourage actors, who have to carry out the work
implementation stakeholders and end-users	Proper dissemination of information: public campaign, workshops, website, info point (central, regional)	- create awareness - easy access to information is first step towards taking energy savings	'- high costs for public campaigns and dense information networks
implementation stakeholders and end-users	Link to other policy instruments	- when the certification system is coupled to financial support, more commitment is created to take energy saving measures, i.e. white certificates, rent price valuation system, subsidy for volunary tailored advice, subsidy for saving measures - (regional, national) campaign on energy savings in existing buildings can enforce the impact of the energy certification system	- effective subsidy programms for modernisation in the building stock have to be based on a lasting and profound political commitment and are very costly
end-users	Certificate supplied with sale agreement	- direct access of information to new building owner	
end-users	Certificate supplied with rent agreement	- direct access of information to new building habitant	- In France and Germany housing associations are reserved to inform tenants about the improvement measures, because they fear that tenants will demand energy savings and they can possibly not ask higher rent in return for their investments

Although energy certificates are mandatory, the Danish experience from the past teaches us that this does not automatically generate a broad public awareness. Information campaigns about this specific element of the EPBD are essential for a proper functioning of the energy certification scheme in the building market. The dissemination of information has to be tailored to the various target groups, such as house owners, tenants, housing associations, energy consultants etc.

In addition, an early involvement of essential market actors in the formation of the national policy concerning energy certification brings about awareness and com-

mitment for (new) energy certification schemes. At the same time possible barriers will be recognized, thus offering the opportunity for policy makers to anticipate on these problems at an early stage.

4.5 Building inspection

Enough available well qualified experts make or break the quality of the building inspection. So the quality aspects of the building inspection are closely related to previous aspects discussed (see paragraphs 4.1 Capacity of experts and 4.2.1 Quality of experts)

In the German IMPACT tests sensitivity analyses on a simplified (using default values) and an extensive method were carried out. Because of the direct influence for input data during the building inspection, the main outcomes are presented in this paragraph in the textbox below.

Sensitivity analysis of simplified and extensive methods in Germany and Belgium

A simplified approach uses default values, in case values of the input data are not easy available.
Geometric simplifications allow neglecting the following elements:

- Dormers occupying less than one third of the total roof surface.
- Projections and offsets in the façade with a depth of less than 20 cm.
- Additional surfaces in the area of basement steps.
- Heated rooms in an otherwise unheated roof-space (loft) or basement with a floor-space of less than one third of the total floor-space of the loft or basement.
- Additionally window areas could be estimated to 20% of the floor space, if windows weren't significantly small or large.

A.o. it is concluded that:

- Certain simplifications may be permitted if no detailed information is available or if its determination is too expensive or time consuming.
- Simplifications should not, as a rule, lead to an improvement of the results (default values used in simplifications should not lead to more positive results).
- Neglected parts of the building should be listed in the energy certificate in such a way that references to improvements also include a (general) indication of the improvement potential of these parts of the building.

The sensitivity analysis in the German residential buildings test proved that the simplified method using default values leads to acceptable results and generally leads to only slightly higher calculated energy demands.

Furthermore, the experts regarded the technical default values sufficient and correct. In addition, they indicated that further simplifications on the buildings geometry and surface areas would significantly reduce the time needed for inspection. For non-residential buildings also a more simplified approach for the zoning would be appreciated by the experts.

In Belgium the sensitivity for a complete set of input parameters has been studied as a first step to come to rules for simplifications.

[References: IMPACT/17-18/2006/WP2.2 and IMPACT/27-28/2006/WP2.5]

4.6 Calculation energy performance

4.6.1 National characteristics

It should be mentioned that in most countries studied the calculation tools are still under development during the IMPACT project.

Basics of methods

Within the IMPACT countries two strategies can be distinguished regarding how calculation methods are defined:

1. The calculation method is defined in national and/or European standards. The legal decrees give the references to the calculation methods in the standards. The transposition of the method into software tools is left to the market (Germany, possibly The Netherlands).
2. The calculation method based on national and/or European standards is implemented in a national certification tool. All certificates will be produced with the same calculation engine as also used in the calculation when showing compliance with the building regulation. In Denmark only the calculation core is provided and prescribed nationally. User interfaces can be developed by market actors.

Operational or Asset rating

Most countries use calculations to determine the energy performance of a building and the same method serves as basis for the label system. In addition, some countries use operational rating for specific building types, such as non-residential buildings. In case of operational rating, the labelling system is based on a benchmark system, comparing measured and climate corrected energy consumption with typical energy consumption per m^2 of floor area per building category (schools, hospitals, offices etc.). An overview of which type of rating is used for energy certification in the countries studied is presented in Table 12.

Table 12 Overview of which type of rating is used for energy certification in several EU-countries

Country	Operational rating	Asset rating
Belgium	Flemish region: public buildings	New buildings
Denmark		All buildings
France	Residential buildings with individual heating and old residential building (<1948) with central heating systems Non-residential buildings	New buildings and existing residential buildings
Germany *	Non-residential buildings (free choice)	All buildings, non-residential buildings (free choice)
Spain		New buildings, existing buildings still unknown
The Netherlands		All buildings

* Detailled explanation Germany: Free choice of method for non-residential buildings and residential buildings with the below stated exceptions: Calculated rating mandatory for all new and substantially renovated buildings and residential buildings with less than five apartments / units and built before first Thermal Insulation Ordinance of 1978. (current draft EnEV amendment of November 16th 2006)

Both operational rating and asset rating have as well advantages as disadvantages. An overview of these pros and cons is shown in Table 13.

Table 13 Asset rating versus Operational rating, their advantages and disadvantages

Method	Pros	Cons
Operational rating	In general, - input data are simply available, - little time needed, - low costs, - possible to use automated readings. - not so sensitive for mistakes - directly recognizable for end-user - can be good alternative for large buildings	Data collection based on meter reading mixes up building efficiency and users' behaviour. Moreover, it depends on the existence of meters, or better meter readings or credible reports from supply companies. Standardisation is needed. Need for differentiation of typical energy consumption per building category (benchmark system) Difficult to identify energy-saving measures. In addition, difficult to calculate pay-back time of energy saving measures.
Asset rating	The on calculation awarded label is based on standard behaviour and represents the quality of the buildings and its energy systems. Reliance on calculation makes it easy to make a break-down of energy consumption into single contributions. Easy to make adjustments to standardised use of the building and to estimate energy savings.	- more time consuming, - more sensitive for mistakes. However, this barriere can be overcome by education, support and guidelines. - expensive. depends on a corps of well educated energy consultant, ande agreement on a specific calculation method. - not necessarily useable for large buildings. - not always directly recognizable for end-users. In case there are considerable differences with measured values, the outcomes of the calculations have to be clarified to the end-users.

4.6.2 What are options for a calculation method with an acceptable accuracy and acceptable costs?

In several countries (Denmark, France, Germany, the Netherlands) more or less independent from each other, we observe a similar approach: namely to use several levels of complexity in the calculation method. This is the result of the search for an optimal balance between efficiency (time, costs) and the required accuracy of the outcomes. In France the development of a simplified method was dictated by the use of experts relatively inexperienced in the field energy (lead-asbestos-termites specialists).

These calculation methods are characterised by the possibility that standard default values can be used in case detailed data are not easy available. The outcome of the calculation with default values is less accurate than in case building specific data are used. However, it is assured that the reliability of the outcome is acceptable.

In general, operational rating requires less time and costs than asset rating. So it can be investigated if operational rating is an acceptable alternative for asset rating. Preconditions are that: (1) input data of several heating periods are easy accessible, this depends on the cooperation of building owners (2) classification per building type is possible (enough building specific data available for benchmarking and similarities within one category). Operational rating limits the scope of recommendations for improvements to standard recommendations. To limit the influence of the user behaviour, the operational rating can be limited to large multi-family buildings. To reduce the influence of local climate (relevant especially for countries with different climatic zones) correction factors can be used.

Calculation methods to determine the energy performance of new buildings are often different from calculation methods to determine the energy performance of existing buildings. However, most of the countries studied acknowledge, that it is best to have one labelling system, because the new buildings of today are the existing buildings of tomorrow. This implies that the calculation methods have to be based on comparable starting points.
From the IMPACT tests of among others Belgium, it appears also, that it is important to relate the recommended energy saving measures to the possible impact on the indoor climate.

Certification of flats in Denmark

Denmark had already a certification scheme in place since 1997. The aim in IMPACT was to optimise and test the certification scheme for apartment buildings, as the existing scheme was not adopted well by energy consultants, real estate agents and owners of flats. Energy certificates were only prepared for approximately 20-25 % of the traded flats. The scheme was perceived as not attractive, too expensive and not reliable (e.g. calculated consumption differed from metered energy consumption).Within IMPACT a new approach for the certification of flats has been tested.

Key elements in this new approach are:

- The energy label and the savings are based on a calculation for the whole building (asset rating). The energy label class for the whole building and for each individual apartment is the same.
- The inspection and calculation procedure are based on using typical apartments for describing the overall building which leads to lower certification costs.
- The displayed energy consumption for heating is based on the metered and climate corrected energy consumption for the whole building. For each individual apartment the energy consumption for heating is calculated by dividing the energy consumption for the entire apartment building by its total area and multiplying by the area of the apartment. When there are more similar apartments in a building also size categories can be used for this calculation. This calculation matches with the dominant way (>98%) of distribution of heating costs in apartment blocks. For apartment blocks with individual heating systems a different approach is described in the national report.
- The certificate describes the whole apartment block on 6-8 pages and additionally a one page certificate will be issued for each apartment. This page includes a description of how the individual payment for each apartment takes place for this building and furthermore the energy consumption of the apartment.

In several countries it is not finally decided yet how to take care of the energy certification for apartment buildings. It might be interesting for them to learn from the Danish approach.

[Reference: IMPACT/25-26/2006/WP2.4]

Calculation methods and tools in Spain
Two calculation tools were tested. The first, called LIDER-CALENER_VYP, is the official Spanish certification tool. The second tool, called EPA (ED and NR), is developed in the framework of a European project. The LIDER-CALENER_VYP is based on a complete building simulation, needs a detailed input of data and is quite complicated to use. EPA is quite easy to use with less additional training. However, it does not generate an energy certificate automatically. During the tests, it appeared that both tools still need further development. For both tools improvements suggestions have been given to the developing teams.
From the IMPACT test it is recommended to look after a more easy and practical energy certification calculation procedure (like EPA) and take the simplified calculation methods of other countries (Denmark, France, Germany and the Netherlands) into consideration.

Based on the findings of the Impact test, the Catalan government considers to develop a new, more simple tool, but this tool will not be available in short time.

[Reference: IMPACT/30-31/2006/WP2.6]

4.7 Certificate, report and presentation

4.7.1 National characteristics

Not in all countries studied official certificate formats or even draft versions were available yet. However, an indication of the underlying approaches for certificates in the various countries can be given.

Germany will separate the energy certificate from the renovation recommendations. The certificate is reduced to basic information to comply with the national building legislation and the EPBD. In Belgium (draft for Flemish region) the certificate for new buildings contains standard recommendations regarding the building use. In Germany the tailored renovation measures are listed on a separate page which has to be issued with the certificate as an annex.

In the Netherlands a simple and concise energy certificate which includes a list of important energy saving measures. The certificate can be supplemented by more comprehensive tailored energy advice report on a voluntary basis.

In France and in Denmark the tailored advice is included in the certificate format. In France there will be three different formats, one for residential buildings based on the calculated demand, one based on the metered consumption and one for non-residential buildings (metered consumption). The Danish certificates are in principle the same for all building types, with only small variations. For multi-

family buildings, the entire building will be described in the main certificate and additionally each apartment will be described on one extra page.

The Spanish software until now only produces the energy label, which is not yet integrated into an individual report, but will be included in the building documents.

An overview of the items on the energy certificate is presented in Table 14.

Table 14 Components of energy certificate (indicative)

Country	Items included in energy certificate
Belgium	- the compliance with the national legislation - the primary energy consumption per m^2 - (standard) recommendations for the best use of the building
Denmark	*Concerning multi-family buildings* - the measured climate-corrected heating consumption for the whole building - based on a calculation for the whole building with standard input data a label A1 to G2 is given - recommendations for cost-effective energy and water savings including costs and savings - a description of the whole building on 6-8 pages and additional each flat will be described on one page. This pages gives information about the individual payment for each flat and furthermore energy consumption based on measured climate corrected heating consumption for the whole building divided by the total area and multiplied by the area of the flat
France	- an energy scale in primary energy - an environmental scale in CO_2 emissions - general advices on energy savings - specific recommendations on energy savings, including investment costs, energy savings, pay-back time
Germany	- energy label with the value of the building and reference values (primary and final energy consumption for residential buildings, only primary energy consumption for non-residential buildings, metered rating: final energy consumption) - building description: date of construction, date of heating systems, number of flats, heated floor space, picture of the building, address of owner - registration number and date of issue, address of issuer - legal requirements and results for building envelope heat transfer coefficient and overall primary energy demand, CO_2-emissions (informative) - final energy demand on basis of energy sources (oil, gas electricity) - recommendations for renovation measures: two renovation packages, primary energy demand of building after renovation, description of the measures - metered energy consumption (optional) metered energy consumption per year, primary energy consumption for comparison - explanations for owners, tenants and experts

Country	Items included in energy certificate
Spain	Not decided yet. Next indicators are reported by the last draft Royal Decree: - building location / climate zone (according to the CTE) - building use, type of building - energy Label (A - G) - tool used - final energy use in kWh/year and kWh/m^2 - CO_2 emission in CO_2/year and CO_2/m^2
The Nether-lands	- energy label - list with possible energy saving measures, based on standardised calculation - energy consumption in MJ/m^2 On a voluntary basis a tailored energy advice report can be offered.

4.7.2 What are options to make a certificate understandable?

From the tests in IMPACT it became clear that at least attention has to be paid to several aspects of the comprehensibility of the certificate. These aspects are:

- Avoid misunderstandings on differences between calculated and metered values (energy bills). E.g. use a label based on asset rating and display the metered energy consumption on the label (as the calculated energy consumption is a mix of heating and electricity consumption (and this even calculated with a factor) (Denmark).
- Technical terms such as primary energy demand need to be explained to end-users.
- In case end-users are considering to take energy saving measures, they usually need to have additional information. For these follow-up activities easy access to more specific information has to be taken care of.

In Table 15 the findings from IMPACT about how to make a certificate understandable are expressed.

Table 15 What are options to make a certificate understandable? Findings from IMPACT field test, including their advantages and disadvantages.

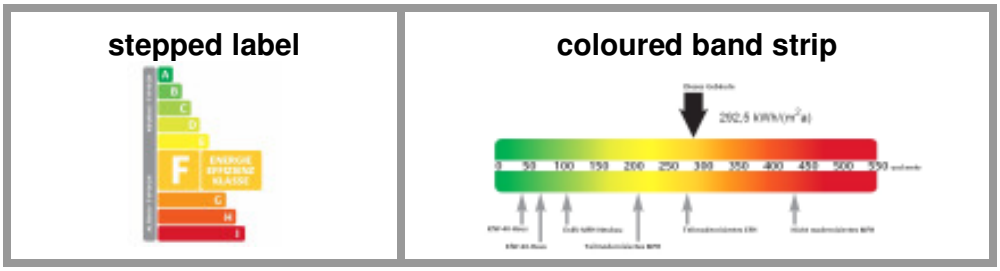
Content elements of energy certificate	Pros	Cons

Presentation of energy consumption. Several possible options, also a combination of options can be presented.
- Unit expressed in:
  - final energy
  - primary energy
- Measured values
- Calculated values
	Final energy : directly clear to building owner
	Primary energy : total consumption is clear (sum of heat and electricity becomes possible)
	Measured values : directly clear to building owner
	Calculated values : relation to label directly clear to building owner
		Primary energy : additional explanation needed about calculation from final to primary energy
		Measured values : in case of asset rating, this can lead to misunderstandings (can be overcome if only label is mentioned)
		Calculated values : this can lead to misunderstandings when there is a considerable difference compared to measured values on energy bills. In the Danish IMPACT field trial for apartments this barrier is overcome by presentation of the from the measured value of the total building derived value, and in addition only the label is mentioned (not the calculated value).

Presentation of energy label. Two label types are researched within IMPACT: - based on categories (A, B, ….) - continuous basis, coloured band strip	- both label types give direct insight in energy performance of the building. Most countries in the IMPACT project use the category based system, from the field trials it appears that it is understandable and acceptable for the end-user. In Germany both label types tested, it appeared that the is a slight preference for the coloured band strip. The legal label format in Germany will be the coloured band strip label.	
Presentation of energy savings. Several possible options, also a combination of options can be presented. - standard recommendations, general advice and/or advice based on simplified calculation method - tailored energy advice	*In general* : create awareness of opportunities and direct incentive to take measures *Standard recommendations* : low costs, general advice create awareness about simple cost-effective energy saving measure (e.g. lowering heating temperature) *Tailored energy advice* : direct insight in important measures for the certified building	*Standard recommendations* : it may be possible that due to specific technical aspects a measure is not applicable for the certified building, this may lead to misunderstandings by the end-user *Tailored energy advice* : higher cost, not sure if buyer intentions are to take energy savings, he does not pay for the certification/advice and is not automatically commited
Easy access to explanation and information for follow-up activities, e.g. name and telephone number of the expert, or of the regional/central info point	- direct access of building owner to information channels	- updating and providing good information (hotline, service points etc) is costly

Comparison of different label types in Belgium and Germany
In the Belgian and German IMPACT field test the end-users attitude to two different label types were investigated.
In the German residential test the participants could choose between an energy class label and a coloured band strip label. In the Belgian test the Flemish draft certificate contained a linear indicator label, whereas the energy advice report contains several A to F class labels. The results in both tests have lead to contrary results. The classes were far more appreciated in the Belgian test. In the German test the coloured band strip was slightly more accepted. This was particularly true for housing companies.

[References: IMPACT/17-18/2006/WP2.2 and IMPACT/27-28/2006/WP2.5]



4.7.3 What is needed to get the certificate accepted by the end-user?

Within the IMPACT project an inventory is made on how the market experiences the certificate. In all IMPACT partner countries the certification was accepted by the end-users. The only actual reported obstacle was by housing associations. They have problems with the displayed recommended energy saving measures, because they fear that tenants use this information as argument for requesting improvements or for not paying the (entire) rent.
Most of the questioned end-users appreciate the energy label, additional information and transparency of the certificate.
Following aspects were mentioned to play a role in the end-users acceptance:

- Clear content and layout
- Official approved document, (mandatory certificate format)
- Good performance experts
- Limited cost
- Customise the certificate by adding a picture of the building
- Personal presentation / elucidation

Concerning the latter aspects, within the various IMPACT tests, it was expressed that the presence of a picture of the building in the certificate and personal presentation is highly appreciated by end-users.

Belgian market surveys show that the energy consumption and the advice are primordial; indicators such as comparison to other (standard) buildings, financial data, CO_2-emission or renewable energy are not. Besides, it is important to refer to legal constraints.

4.8 Action to implement measures

4.8.1 National characteristics

The ultimate aim of the EPBD implementation in the EU member states is to incite energy saving measures in buildings. The information on the certificate can be regarded as the basic insight on energy saving potentials in the building.

In the IMPACT field test of 4 participating countries is investigated if the attitude of stakeholders (building owners, tenants) towards energy savings is altered as consequence of the certificate. Several summarized findings:

- In Denmark, 56% of the building owners and 77% of the tenants' questions stated that the certificate has led to their wish to reduce their energy consumption.
- In France, 59% of the end-users stated that they want to restore their dwelling.
- In Germany, about the same percentage of own-property users stated that they will now restore their dwellings. For about 40% of the own-property users and the private landlord the certificate prompted the renovation activity. For about 35% the planning was facilitated by the certificate.
- In the Netherlands 27% announced on basis of the certificate only that they intend to implement energy saving measure in the coming year. Two third of these respondents (18%) had not had any intentions to implement energy saving measures before receiving the certificate.

Based on these findings it can be concluded that energy certificates incite energy saving measures in buildings. However, to what extent is not yet completely clear.

4.8.2 How to challenge end-users to take energy saving measures?

For the findings of the IMPACT study with respect to this question is referred to Table 16.

An essential precondition to take investment decisions about energy saving measures is that insight is gained about the costs of the various options in relation to the benefits. Besides costs, end-users look at other aspects, such as com-

fort level, as well. In this respect, it is important that other possible benefits of energy saving measures are closely communicated.

Several ways on how to promote energy saving measures through certificates are already discussed in previous paragraphs. Two approaches can be distinguished according to the position of the tailored made energy advices:

- It can be an integral part of the energy certificate.
- It can be offered on voluntary basis.

Both approaches have their pros and cons, which are presented in Table 16.

Finally, the impact of energy certificates can be enforced by embedding the instrument in the overall policy to incite energy saving in buildings. This can be done by directly using the recommended energy savings and label on the certificate as basis in other policy instruments. For instance: in the Netherlands there are initiatives to couple upwards label shift to financial support. In Germany the national kfW bank has just launched a large federally financed subsidy and low-interest-loan programme to support energy efficient modernisation. The approval of the grant is coupled to the results in the calculated energy certificate. The situation in Denmark is that the governmental buildings have to carry through the recommended measures which have a pay back time of 5 years or less. This has to be done within a period of 4 years.
The energy certificate can also be used to improve the access of information about energy savings towards end-users.

Table 16 How to challenge end-users to take energy saving measures. Solutions from the IMPACT project, including their advantages and disadvantages

Solutions	**Pros**	**Cons**
Insights on certificate in impact, cost, pay back time of energy savings. From findings of the IMPACT project (e.g. Belgium) it appears that also other arguments have to be communicated, improvements of comfort level, indoor climate etc.	- these insights are needed for investment decisions, first step towards realisation of energy saving measures	- pay back time might be tricky, therefor also other arguments have to be closely communicated, improvements of comfort level, indoor climate etc.
Personal presentation of the certificate and energy advice	- this is of importance for a good understanding of the energy saving measures, their applicability in the specific dwelling and their impact on bills, comfort level etc.	- often energy certificate is an assignment of the seller, while the buyer will be interested in the advice
Split certificate and standard recommendations for energy saving measures for party that sells from (voluntary) tailored advice for party that buys	- address directly right information to right persons	- only limited part of the building stock will be reached Therefor additional promotion campaigns and link to additional incentives are needed to reach bulk of market
Energy tailored advice is integral part of energy certificate	-direct to the point information about energy savings, misunderstandings are avoided - entire market is in principle been reached	-more time consuming and more costs than general/standard recommendations
Easy access to professional information. Some options: - central, regional info point - telephone number of expert, or central, regional info point on the certificate - link on the certificate to website where local craftsmen can be found	*In general* : direct access to information, also for new buildings owners, habitants In case of website to trace *local craftsmen* : direct access to local craftsmen who can carry out energy saving measures	In case of *detailed information from expert on the certificate* : - increase work load experts, - experts have to be specialised on energy savings in buildings In case of website to trace *local craftsmen* : fair competition and independent advice have to be guaranteed

5 Main outcomes and conclusions

The main outcomes of the national IMPACT tests are summarised in Table 17.

Based on findings in the national tests, the conclusion can be drawn, that energy certificates incite energy saving measures in buildings. However, to what extent is not yet clear.

In order to be able to translate the findings of the national tests to general recommendation and guidelines for other countries, the energy performance certification process has been split up in process steps. Subsequently for each process step quality aspects and main questions regarding implementing and carrying out energy performance certification have been defined.

Good practice guidelines have been developed by answering 10 of these main questions covering the different process steps in energy performance certification of buildings. These guidelines for good practice are summarised and presented in the executive summary.

Table 17 Main outcomes of IMPACT field tests

Quality aspect/process step	Outcomes	Countries
Expert capacity / overall process Expert quality / overall process	Health and safety inspectors, (master) craftsmen and chimney sweepers can successfully issue certificates for residential buildings.. Preconditions for success are: use of a simplified method and training in both energy certification and energy savings in buildings.	France, Germany
Accurate and effective calculation method/ calculation Efficiency, required time and cost / overall process Understanding of end-users / certificate and presentation	For apartments a specific approach is developed. The calculation and recommendations concern the entire apartment block. The entire building and each individual apartment all have the same energy label (based on asset rating). The certificate describes the overall building on 6-8 pages and additional one page with specific information of the apartment transferred. The mentioned energy consumption is based on the measured (operational) climate-corrected heating consumption of the whole building. For the individual apartment certificates this consumption is divided by the total building area and multiplied by the area of the apartment.	Denmark
Accurate and effective calculation method / calculation	A complex calculation method based on building simulation generates a high workload, requires specialists and is sensitive to mistakes.	Spain
Efficiency, required time and cost / overall process	Split the tailored energy advice from the more standard recommendations on the certificates. This can also help in help in addressing the different interests of seller and buyer of a home with the appropriate information.	The Netherlands
Efficiency, required time and cost / building inspection	End-users can be involved in the preparation of the building inspection for the collection of general building characteristics and drawings of the construction.	The Netherlands
Understanding of end-users / report and presentation	The label based on classes were far more appreciated in Belgium, while in Germany the coloured band strip was slightly more accepted. This was particularly true for housing associations.	Belgium, Germany
Acceptance of end-users / certificate and presentation	Important criteria for acceptance of the certificate are: - Clear content and layout - Officially approved document - Good performance experts - Limited cost - Picture of the building Personal presentation / elucidation is highly appreciated	Belgium, Denmark, France, Germany, the Netherlands

References

This report is based on the results of the national IMPACT tests and discussion in the IMPACT consortium. The national results are described in detail in the following reports:

IMPACT/12/2006/WP2.0 Impact National energy performance certification tests – Compilation of national test reports, Dena.

IMPACT/13-14/2006/WP2.1 Impact National energy performance certification tests – The Netherlands, Ecofys and SenterNovem.

IMPACT/17-18/2006/WP2.2 Impact National energy performance certification tests – Germany, Dena.

IMPACT/22-23/2006/WP2.3 Impact National energy performance certification tests – France, TRIBU ENERGIE.

IMPACT/25-26/2006/WP2.4 Impact National energy performance certification tests – Denmark, SBi.

IMPACT/27-28/2006/WP2.5 Impact National energy performance certification tests – Belgium, BBRI and 3E.

IMPACT/30-31/2006/WP2.6 Impact National energy performance certification tests – Spain, Ecofys S.L.

All IMPACT reports can be downloaded from the IMPACT site: www.e-impact.org.

Rossi et al, 2004 Rossi, P.H., M.W. Lipsey and H.E. Freeman, 2004, Evaluation, A systematic Approach, 7th ed., SAGE Publication, Thousand Oaks, CA, USA