

# New challenges for energy certification of dwellings – we keep on learning

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## Keywords

energy certification and labelling, existing dwellings, training, building energy statistics

## Abstract

In many European countries energy certification of existing dwellings is in an early stage of application. What have we learnt till now?

Four main issues arise: how can we make the procedures less expensive and thus more acceptable for society, how can we nevertheless assure quality, how can we further improve the training of experts and finally what to do with the large amount of building and energy data resulting from energy certification?

These issues are addressed on the basis of recent (2005-2006) field experience in Belgium. Over 300 energy experts have been trained in the last 2 years, feed-back information was evaluated. In addition the quality of the audits was controlled by several at random on-site check ups. Since the number of audits performed is limited, a quality evaluation is not yet possible, but certainly worthwhile in the near future, also with respect to experiences in other countries.

At the same time the cost of the audits was very high and strongly dependant from expert to expert. This was a major drawback for the implementation. Therefore an analysis is ongoing in which the balance between cost and accuracy is re-evaluated. Some time-saving tools are discussed.

Finally a concept has been developed to process the large amount of valuable data resulting from the energy certification. Data from energy certification can be highly valuable for other studies and government policy programs. This last issue

is being developed in the framework of an EIE-project called DATAMINE.

## Introduction

At the moment the Energy Performance Directive for Buildings is in an early stage of application in Belgium, as in many other countries. In one region the legislative framework for energy certification of new buildings is already a fact. For existing dwellings until now a voluntary auditing and labelling scheme is available, called the EAP – Energy Advice Procedure. A web-based software, training programme and help desk is available for this scheme. The focus of the EAP however is the energy advice (no official certificate is produced) and the application area for the moment is limited to single family dwellings, apartments are not included.

The procedure is based on the normalized European heating calculation methods being developed, but does not take lighting or air conditioning into account. The procedure covers however the three large parts, the building envelope, the heating installation, and the hot tap water. The EAP-procedure equally foresees the control of the thermal comfort during the summer and the ventilation [1].

The building is divided in several sub parts: heating installation with production, distribution, emission and control, hot tap water with production, distribution and storage, and finally the different parts of the envelop: walls, roof, floor, ... The EAP-procedure shows for each part a label, energetic losses and gains, as well as energetic and economic effects in case of renovation. This is calculated for every separate part, for combinations, and until the composite entity. Together with the judgement on the classification of a specific part, a recommendation

for an improvement is produced and the results of this potential future intervention is calculated. For every analysed house, a report is composed, including all technical details, practical explanations of the procedure and technical sheets for every proposed intervention.

The procedure produces its results therefore not only as a certification and a label for the existing situation, but at the same time by presenting a possible future situation where the weakest parts have been renovated.

For certification purposes the EAP is at the moment evaluated as too expensive and not fully compatible with the EPBD requirements.

Therefore the main efforts in Belgium are nowadays focused on 3 improvements:

- The development of a more simplified, cost-effective scheme with major focus on certification according to the Energy Performance Directive
- The extension of the application area towards apartment blocks
- The improvement of the training programmes for building experts

This paper summarizes some results of the recent activities on the focal points as mentioned above.

## Cost of energy labelling

### MARKET ACCEPTANCE OF ENERGY AUDITS FOR RESIDENTIAL BUILDINGS

As energy certification for existing houses has not yet been implemented in Belgium, the Energy Advise Procedure is currently only performed on a voluntary basis. This can be of interest for house-owners who recently bought a house, and want to know how to renovate in an energy-efficient way.

One major disadvantage is the high price of the energy audits. During the start-up phase, prices fluctuated from 250 EURO to

2 000 EURO per audit. This is a normal phenomenon in emerging or new markets. After some months, the prices stabilised between 400 and 600 EURO per audit. This remains a fairly high price for a thorough evaluation of a building. It is however quite reasonable from the point of view of the auditor. A detailed audit easily takes one day of work. When counting an hourly rate between 35 to 60 EURO, the total price can amount to 500 EURO.

Some financial support is available for these energy audits. On a federal level, thus available in all three regions, is a fiscal deduction of 40 % of the audit price. This is a large part, but it takes in practise two years between the payment of the bill and the recuperation of the 40 % through fiscal deduction. Secondly, the deduction is only interesting for households who already pay taxes, thus not for the lowest incomes.

Secondly in the Walloon region, an additional subsidy of 50 % with a maximum of 300 EURO is available. At the same time, other subsidies for energy efficient measures are subjected to the prior execution of an energy audit. For instance, subsidies are available for floor insulation of additional wall insulation. However, before the Walloon administration accepts a request for these subsidies, they need a result from an official energy audit which states that the measure is actually effective in this building.

VITO conducted a large-scale enquiry for the market effects of audits and certification amongst building owners. This enquiry happened in the framework of the European STABLE [2] project under the Europe Intelligent Energy program. Results presented in **Fel! Hittar inte referenskälla.** show that most of the building owners are not willing to pay a lot for certification or audits. Only a minor part of the owners is willing to pay more than 200 EURO. For the major part a cost of 100 EURO is acceptable.

Although the energy certificates will become mandatory, the regions do not want to impose the considerable cost of the certificate. The direct cost for society is too high. The aim is to reduce the cost for the procedure to about 100-150 EURO this means 2,5 to a maximum 4 hour per dwelling, transport and advice included. Therefore following roads towards simplifications are being explored.

### SIMPLIFYING THE AUDIT AND CERTIFICATION PROCEDURES

A typical audit can be divided in following tasks – See Table 1:

As shown above, the major reduction in time spent is expected to be achieved in the analysis of the building envelope. In the actual procedure this activity is the most time consuming (about 50 %) and largely depending on the complexity of the building geometry. Measuring the dimensions of the different building parts and the determination of the correct composition of walls, floors, roofs, windows,... are sometimes time consuming.

One possible solution for this, is working with decision trees. A decision tree will help the expert in finding a fairly representative wall composition on the basis of simple visual observations. The principle is that it is not worthwhile to search a long time for wall details of which the accuracy is difficult to establish. This is certainly the case for most dwellings where wall compositions are not known in advance. Taking this into account, examples of these decision trees are being integrated in the used audit software (EPACT) in the Netherlands.

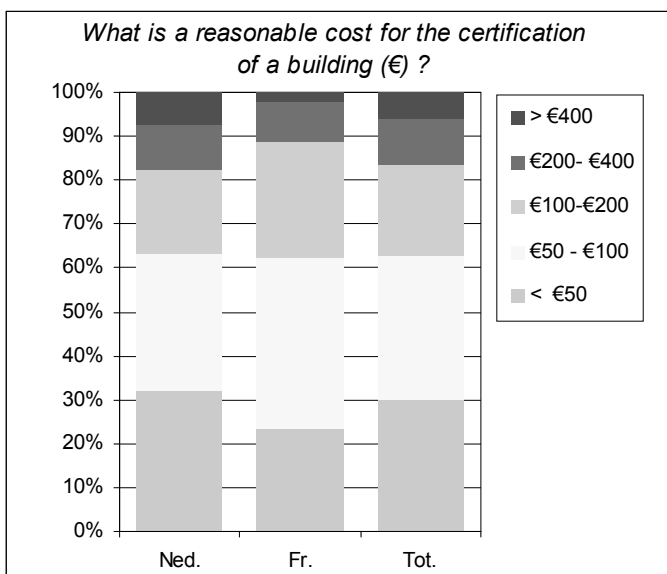


Figure 1: Results of enquiry on the market acceptance of audits and certification (Ned=Flemish, Fr=Walloon)

Table 1.

Activity	Normal time spent	Simplified version
Analysis of building envelope	2–4 h	1–1,5 h
Analysis of building installation	0,5–1 h	0,5 h
Advice	1–2 h	0,5 h
Transport	0,5–1h	0,5–1 h
Total	4–8 h	2,5–3,5 h

There are however some issues one should consider carefully in using decision trees:

- Decision trees depend largely on the existing building practices in a specific country; solutions found for one country can therefore not be transposed to another country without thorough examination. The more complex the building practices, the more complex the decision trees will be.
- Decision trees do not affect the time spent in the building geometry. To reduce this activity other methods as projection of surfaces can be used to save time.
- Decision trees can enhance the reproducibility of energy audits. For instance the wall thickness can be a decision factor to choose a certain wall type with a specific composition. Nevertheless it is important not to neglect parameters with a significant impact on the energy certificate: e.g. insulation thickness and type of insulation. In Belgium no decision has yet been taken on the simplification of the audit using decision trees.
- In general it can be stated that reduction of the necessary time to produce an energy certificate and to give an individual advice, are likely to be achieved when larger quantities of similar dwellings (social housing,...) can be treated. The possibilities for a more individual building market, as the Belgian one, are not yet obvious.

For the moment in Belgium following elements are under discussion, meaning that inspection is not easy but nevertheless necessary since the impact on the energy certificate is of major importance:

*On installation level:*

- Type and age of boiler/burner for central heating
- Temperature control of the boiler water
- Load of the boiler
- Control of the circulation pump
- Uninsulated piping in non-heated spaces

*On insulation level:*

- Insulation thickness
- Lambda value of the insulation

All considerations above take into consideration that an individual energy advice remains an important element accompanying the certificate.

## The quality aspects of training

Accuracy considerations of energy certification point very directly to the advisors who will be delivering these certificates. Will they perform their job with enough accuracy to provide certificates of acceptable quality? Although certification is not yet implemented, energy auditing already is. In this situation, the requirement for quality remains the same. Individual homeowners pay to receive a complete evaluation of their house, and they expect qualitative and accurate results.

Belgium is in this respect an interesting case to look at. Energy certification and energy auditing is being implemented on a regional basis. This means that accreditation and training of energy advisors and energy experts is being implemented in different ways in different parts of the country. The three regions responsible for this implementation are the Flemish region, the Walloon region and the Brussels capital-region. The Flemish region was the first to implement accreditation of energy experts. The Walloon region soon followed with a completely different approach towards accreditation. The Brussels Capital-region did not yet implement a system for the accreditation of energy experts. However, they are considering the possibility of allowing both Flemish and Walloon energy experts to operate in the Brussels capital-region.

### ACCREDITATION FOR ENERGY ADVISORS

The system for training and accreditation in Flanders has been the first system to be officially organised. Through the Resolution of the Flemish Government of July, 17<sup>th</sup>, 2005, accreditation and training of energy experts has been put into practise. The requirements are to have an architect or engineer- architect degree, but if properly motivated other persons can submit a request.

It has to be stressed that this training does not yet provide accredited experts who are allowed to carry out energy audits for certification of existing buildings. The accreditation is for the application of the Energy Advice Procedure, However, as already mentioned, the Energy Advice Procedure is at this point in time not an official certification software.

### THE SITUATION IN FLANDERS

Since the introduction of official accreditation in Flanders, energy experts are being trained for energy audits of individual dwellings. The system in Flanders starts from the principle of an individual accreditation. The accreditation is linked to the person and not to the company the person represents. Companies could try to use economies of scale, by employing only some accredited experts, while all the building data are delivered by junior employees. But the individual accreditations make this system very difficult.

One can get an accreditation on the basis of different criteria. Some experts get their accreditation based on their experience. They have to provide proof of several energy-audits performed in the past. This is however a transitional measure. Few individuals have specialised in energy audits for private houses before the release of a standardised procedure.

The main part of the experts receive their accreditation on the basis of a training. This training consists of two parts:

- a theoretical part (24 hours course) about the procedure and the background. This part is not obligatory. Candidates can fill in a test of proof showing they have sufficient knowledge of building physics and building installations. If they pass the test, only the second part of the training has to be followed.
- a practical part (16 hours) about the application of the procedure and the corresponding software.

Finally candidates have to pass a practical test.

At the moment some 350 experts have received this accreditation. Officially, apart from the test to be passed at the end of the training, no specific diplomas are required. The official legislation only requires the candidates to have finished high school. A few months ago, this law has been adopted. Now, when the candidate has not finished high school, but can proof working experience which compensates for the lack of the high school diploma, he is also an eligible candidate. There is no additional basis for qualification. So officially at least, the requirements are very limited. This has been the result of the consideration that a large amount of energy advisors will be necessary in case of implementation of full energy certification. The first estimations guess a number of over 1 000 energy advisors, necessary to implement the energy certification during the first years. This number would be very hard to reach if higher technical levels were required.

#### THE SITUATION IN THE WALLOON REGION

The training in the Walloon region started from different principles. Here the scientific institutes, responsible for the elaboration of the EAP-procedure, were also requested to set up the training. The training was only accessible for experienced architects or Masters of building sciences. The training took 5 full days too. Finally a written and an oral exam both had to be passed in order to complete the training successfully.

The training is therefore much more intensive and requires a larger input from the candidates. The aim of the training is also to acquire a higher technical level.

This has effects on the number of delivered experts. During 2006, only some 40 experts have received their accreditation, some 120 additional trained experts are foreseen for 2007.

#### HOW ACTIVE ARE THE ENERGY EXPERTS FOR THE MOMENT?

The differences in activity between Flanders and the Walloon region are remarkable. At the moment, the largest experience with the auditing system has been gathered in Flanders, as the system has been operational since more than a year. The first results are however quite low. During the first nine months of implementation, more than 200 experts have been accredited by the administration. But only some 140 audits have officially been performed. The system does start rather slowly. At the

moment in Flanders, some 350 energy experts have received their accreditation. Still with this large amount of experts, only some 150 audits have been officially performed.

However, the training centres state that at least 500 to 600 candidates successfully finished their training, and this number is still growing. So it seems that half of the candidates do not ask for their accreditation. They are not willing to actively perform energy audits at the moment. Most of them keep the training as a possible step in the process for further implementation of energy certification. If energy certification of existing buildings will be put into place, several of these 'hidden' experts can return if they judge the situation as interesting enough.

The situation in the Walloon region was expected to be different. As stated above, the support measures are much stronger in this region, as well as the training of the energy experts. This did not immediately result in a stronger market demand for energy audits. At the moment, some 70 audits have been performed during the 6 months since the first accreditation of energy experts in the Walloon region. For the moment it is too soon to evaluate the differences in impact (cost of certificate, quality of audits) between the Walloon and Flemish region.

#### WHAT IS QUALITY OF THE ENERGY ADVICES?

During 2006, VITO carried out the inspection of some residential audits in Flanders. These inspections were carried out on behalf of the Flemish administration. Audits have to be sent to the central server of the Flemish administration, in order to be official. When quality problems are detected, inspections are requested.

Inspections control the actual audit report by visiting the dwelling concerned. Both the technical analysis of the dwelling as interaction with the household is controlled. During these controls, several large problems with the technical analysis have been found. In some cases, the technical results did not at all reflect the real situation. The results were therefore not at all trustworthy.

However, all households concerned were fairly satisfied by the results. They appreciated the report and judged they got value for their money. This is quite disconcerting but logical. Owners do not necessarily have enough technical knowledge to evaluate the results of the auditor. At the same time, this is quite a new market, so owners do not have any references about what to expect or what to ask.

Some owners mentioned that the expert did not have answers for all of their questions. Some of the questions were directly related to the work of the audit and should have been answered as minimum service from the auditor.

This is not uncommon in this kind of emerging markets. It is therefore certainly at the start of this new program necessary to control actively the quality of the different audits. Follow-up and guidance of the auditors and of the customers is an important task during this period.

Finally it is too early to decide how much the quality of the audits will be improved by more extended training or experienced auditors. Because of its different approach the Belgian scene however will offer a good platform to evaluate this aspect in the next few years.

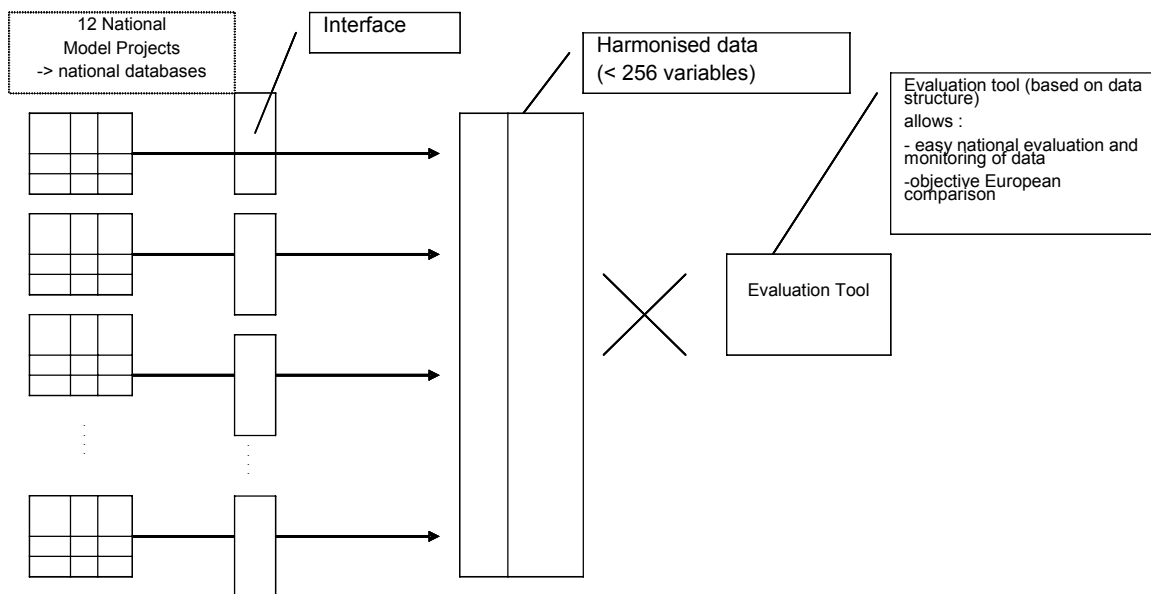
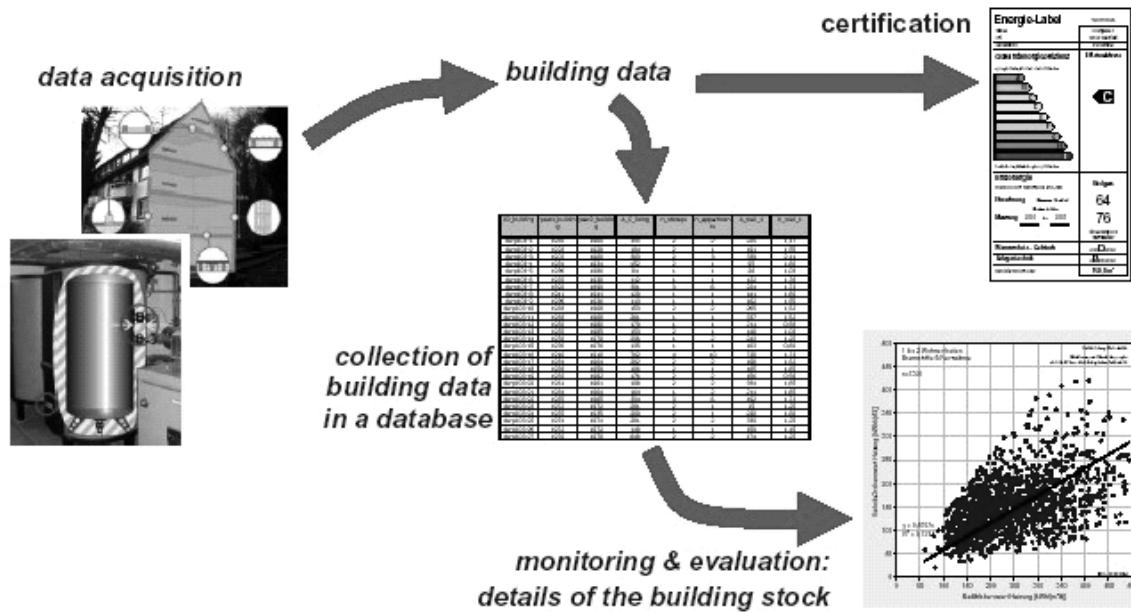


Figure 2 a-b: General setup of the DATAMINE project

**The vast opportunities of building energy data**

The general lack of information about the actual state and the retrofit processes in the building stock is a major barrier in defining well-tailored measures to reduce the buildings’ energy consumption. This is even more so in the case of Belgium. The available data on the existing building stock are very limited. And the existing building stock is incredibly varied and unpredictable. This is due to a highly individualised way of building. This tradition is the main constant during the history of construction in Belgium through the 19<sup>th</sup> and 20<sup>th</sup> century. The result is a large variety of buildings tailored specifically to the wishes of each individual house-owner.

To top this, Belgian house ownership is amongst the largest in Europe. Only few families consider renting as a solution for the long term. Families therefore stay in their initial house for more then 40 or 50 years on average. During this time the needs

of a family change considerably and the house is adopted along the way. Several major or minor modifications are being made during its lifetime. These modifications can be extensions, removal of walls, divisions of the living areas etc... The final result is a complex house with parts of different periods.

For a correct evaluation of the existing building stock, data on these complex structures need to be gathered for a large variety of houses. This is a huge task.

**THE DATAMINE PROJECT**

VITO participates in the DATAMINE project [3], a project funded under the European Intelligent Energy program. DATAMINE aims at increasing the knowledge base by using Energy Performance Certificates as a data source. The project aims at a broad application of monitoring systems in the building sector on national, regional and EU level. In this way, the actual

opportunity could be realised which is given by the great information potential of the large number of energy certificates to be issued by EPBD implementation. Possible outcomes could be:

- the monitoring of the effects of specific policy measures
- the reporting of the EPDB implementation progress in a specific country (and on EU level)
- the definition/refinement of energy classes for energy labelling of buildings
- a quality control system on the level of the accredited energy experts

The idea of this project is to use Energy Performance (EP) Certificates as a data source for monitoring. Considering the great variety of buildings as well as certificate types in Europe and the very different status of EPBD implementation a general monitoring system can only be implemented in the long run. Thus the objective of the proposed action is to make basic experiences in data collection and analysis on a practical level and draw conclusions for establishing harmonised monitoring systems.

The DATAMINE project team elaborates a practical concept for the collection, analysis and utilisation of data from Energy Performance Certificates. A simple data base software is developed to give a survey of the collected data. For this purpose Model Projects are being carried out in 12 EU member states. In the Model Projects data collection and monitoring by use of EP Certificates are being tested on a small scale. Each Model Project has an individual design concerning building and certification types as well as the data collection methods and the monitoring targets.

During this project, some major tasks are:

- to agree on a harmonised intake and evaluation data structure
- to implement 12 individual Model Projects for data collection and monitoring
- to make a cross-country comparison of collection methods and monitoring schemes
- to draw conclusions from the experiences of the Model Projects, especially with respect to the possible future implementation of harmonised monitoring systems on national and EU level.

The figure 2 shows the general approach of the activities in the DATAMINE project.

## Conclusion

The main challenges for the introduction of energy certification in existing dwellings in Belgium are:

- the analysis of cost reduction of the certification and advices procedures
- the quality of the buildings experts by training
- the preparation of systems to make optimal use of the energy data that will become available through the energy certificates.

Costs for energy advices are quite high and vary a lot in the emerging market. On the issue of cost reduction for the moment the development of decision trees to determine building part compositions is carefully analysed but the complex Belgian building practice will not make this an easy task.

About 400 building experts have been trained, their activity however is low since the market for certification of existing buildings is not officially open. Some controls on the quality of the work showed that although end-users were in general satisfied, the actual quality could be improved. This shows the need for a coherent quality system in the future.

First steps in a European project DATAMINE show that energy data resulting for certification are not easily to compare between the countries but can be processed and translated into targeted policy advice. A web-based application of energy certification in this context is a major advantage.

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## Acknowledgements

The authors want to thank their scientific partners in the process of developing the energy audit and certification procedure in Belgium: Belgian Building Research Institute (BBRI) and Institut de Conservation d'Énergie et de Développement Durable (ICEDD). In addition it has to be mentioned that this work is supported by the Belgian regions and by the European Commission.