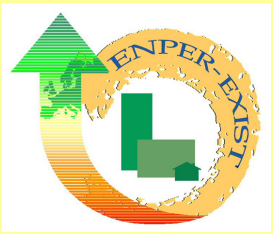

ENPER-EXIST

Applying the EPBD to improve the Energy Performance Requirements to Existing Buildings – ENPER-EXIST

WP2: Legal, economical and organisational impact

Final report

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ENPER-EXIST project information

The ENPER-EXIST project was initiated and is coordinated by the Centre Scientifique et Technique du Bâtiment (CSTB) in the frame of the Intelligent Energy Europe (EIE) programme in the part SAVE of the European Commission, DG TREN. It involves partners from 7 countries on the topic of energy performance standardization and regulation. Contract EIE/04/096/S07.38645. Duration: 01/01/2005 - 30/07/2007.

The Energy Performance of Building Directive (EPBD) sets a series of requirements specifically dedicated to existing buildings but the member states are facing difficulties to implement quickly these requirements. The main goal of the ENPER-EXIST project is to support the take off of the Energy performance of building directive (EPBD) in the field of existing buildings.

ENPER-EXIST has 4 main objectives:

1. To de-fragment technical work performed on existing buildings. Indeed actions already launched in CEN to apply the EPBD are de-fragmented but mainly focus on new buildings. On the other hand different projects on certification procedures are going on at the European level but are not coordinated.
2. To de-fragment work on legal, economical and organisational problems such as the analysis of certification on the market, the human capital and the national administrations.
3. To achieve a better knowledge of the European building stock.
4. To define a roadmap for future actions regarding existing buildings.

ENPER-EXIST uses an intensive networking of existing national and international projects to reinforce efforts to solve these issues. It works in close coordination with the Concerted Action set up by Member States to support the application of EPBD. The work program is split in 4 technical work packages in addition to dissemination and management activities.

WP1: Tools application
WP1 analyses how existing buildings are taken into account in technical tools such as CEN standards, national calculation procedures. Recommendations on how to improve the consideration of existing building are be defined.

WP2: Legal economical and organisational impact
WP2 analyses the impact of the certification procedures and regulations of existing buildings on the market, on the human capital and on the national administration. Surveys are carried out in the different member states and recommendations are drawn up.

WP3: Building stock knowledge
WP3 analyses the level of information available in each country regarding the existing building stock. A procedure enabling to refine this information and ways to use the certification procedure as a tool to collect data regarding this stock is developed.

WP4: Roadmap
An overview of possible legal measures for existing buildings is written. Indications are given about alternative strategies to improve on a wide scale the energy efficiency of existing buildings. Possibilities (including pro's and cons) to widen the scope of the EPBD in case of a future revision of the requirements of the directive are described.

A website, newsletters and workshops enable a strong interaction between ENPER-EXIST and different interest groups and a wide dissemination of ENPER-EXIST results. The workshops are organised with the different actors involved in the application of the EPBD.

More information on the project website: www.enper-exist.com

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Introduction

The main objectives of the present work package are:

a) To study and analyse the non-technical issues related to the application of certification and regulation of existing building processes in the Member States and mainly the financial, educational and administrative aspects. b) To propose specific actions to be undertaken in order to create a more positive environment for the application of certification processes

The overall work involves three main tasks. The specific item of each task is to study the following subjects:

Task 1: The Impact of certification processes in the market

Task 2. The impact of the certification schemes on the Human Capital

Task 3. The impact of the certification process on the national administrations. The present document is an executive summary of the overall work performed in the frame of the present work package. It addresses the methodology used as well as the obtained results and the conclusions drawn.

Task 1 : The Impact of Certification Process in the Market

The main objective of this task is to identify the principal economic impact of the applied certification processes in the market. In particular, to calculate the direct and indirect cost of the certification processes, and to evaluate the possible impact on labour. In parallel, to investigate the possible economic schemes to be developed in order to finance the application of certification schemes.

The cost of the certification process may be classified as direct or indirect. Direct cost is that related to the delivery of the certification services, while indirect is the cost related to all prior and after the certification actions that aim to ensure and improve the certification process.

In general the various components of the cost related to the certification process may be classified in five groups, (Figure 1).

Group A. The Preparation Cost: This involve three main Categories of cost:

- The cost related to the preparation of the documented procedures.
- The cost related to the preparation of the support documents like the tools, the software, etc.
- The cost of the information campaign and the general preparation cost like the creation of new administration, the adaptation of some services, etc.

Group B. The cost of Training. This involve mainly

- The cost of the preparation of the training material, and
- The cost of the Training Delivery

Group C. The cost of Accreditation. Accreditation of the certifiers may be offered either by the State or by Professional Institutions. The whole procedure enables a considerable cost

Group D.: The Direct Cost. This is related to the Delivery of the certification services

Group E: The cost of Quality Assurance and Oversight. It is evident that a quality control mechanism is necessary. Professional Organisations may undertake this either by the State or. In any case an important cost is associated with the quality assurance mechanism.

Figure 1. The various components of the Certification Cost.

1.1 Direct Cost of the Certification Process

The calculation of the direct cost of the certification process involves knowledge of: a) The number of certifications to be carried out on an annual basis, b) The type of buildings to be certified and its complexity, c) The duration of the certification process, d) The cost to be paid for each type of certification.

Using questionnaires all the above information has been collected from all participant countries.

The annual direct cost of the certification process has been calculated as:

Direct Cost (Euros) = NCY x CCB

Where:

NYC is the Number of certifications per year, and

CCB is the cost of the certification per building

Calculations have been performed separately for the residential and the tertiary sectors. Given that neither the number of certifications per year nor the cost can be estimated with sufficient accuracy, two scenarios have been prepared. The first scenario considers a high number of buildings to be certified per year, (NCYH), as well as a high cost per certification, (CCBH). The second scenario, considers a low number of certifications, (NCYL). As well as a low cost per certification, (CCBL). Thus, the upper and lower limits of the direct cost have been estimated.

As it concerns the residential sector, the basic input data, as delivered by the participants, are given in Appendix 1. Thus, the components of the direct cost regarding the certification of the residential buildings are calculated. All the calculated absolute figures are given in table A1 of Appendix 1 as well.

Given that the size of the countries is very different, the direct cost per capita has been calculated and given in Figure 2.

As shown the cost of the certification process per capita and year varies between 3.5 to 10 Euros. For almost all countries the ration of the certified buildings per capita varies between 0,02 to 0,04. (See Table A1 Annex 1). On the contrary, the low certification cost per capita in UK is due to the considered low number of buildings to be certified, (certified buildings per capita close to 0.1).

The same procedure has been followed for the tertiary sector. The used input data, as delivered by the participants are given in Table A2 of Appendix 1. The calculated direct cost per capita for the tertiary sector is given in Figure 3. As shown, the calculated direct cost of the certification process will be between 1 and 4 Euros per capita. Almost similar values have been calculated for all countries. The very high upper limit calculated for Denmark, is because the considered CCBH is extreme and for sure may be applied only for very large buildings.

In conclusion, it has been estimated that the direct cost of the certification process in Europe will range between 3.5 to 10 Euros per capita for the residential sector and between 1 to 4 Euros for the tertiary sector.

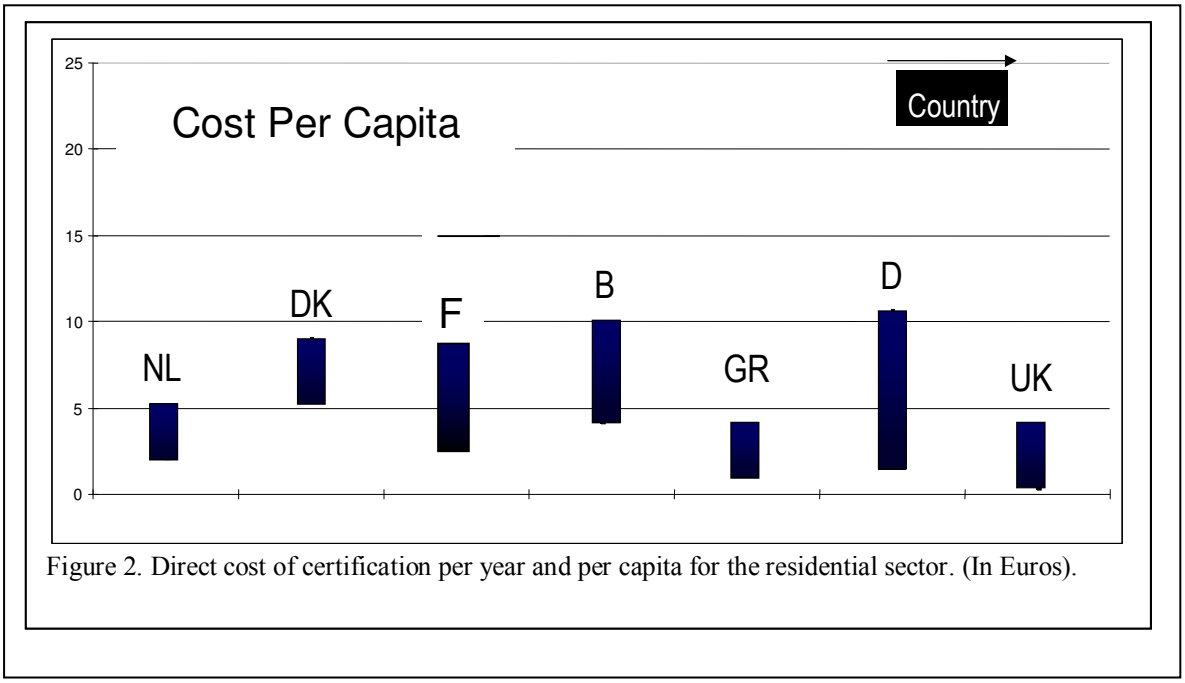
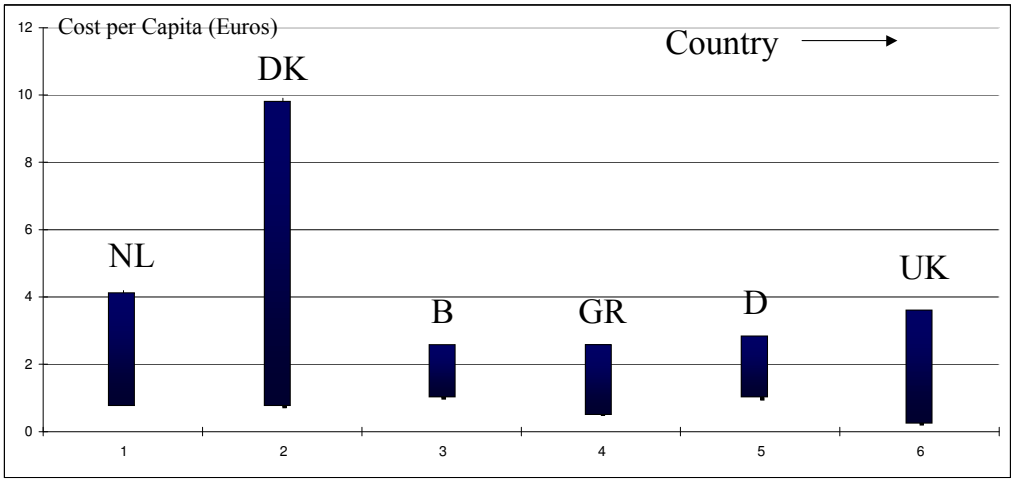


Figure 2. Direct cost of certification per year and per capita for the residential sector. (In Euros).

Figure 3. Direct cost of certification per year and per capita for the tertiary sector. (In Euros).



It is evident that the calculated values can be accepted inside the limits of validity of the considered inputs. It is sure that no exact values for the input data can be found, however, the participants have made the best possible effort to consider the more reasonable and accurate values.

1.2 Indirect Cost of the Certification Process

Establishing and operating a building energy certification scheme involve a mix of direct and indirect costs. The direct costs are those paid by the building owner/occupier to obtain their energy certificate. The indirect costs include the government funded activities required to regulate and oversee the scheme. Other indirect costs, such as the development of software tools, the training and accreditation of experts and Quality Assurance (QA), may be directly funded by government or may be left to the market to provide. Where the market delivers services which support the energy certification scheme, the resulting costs are built into the price paid by the building owner/occupier for an energy certificate (see Figure 4).

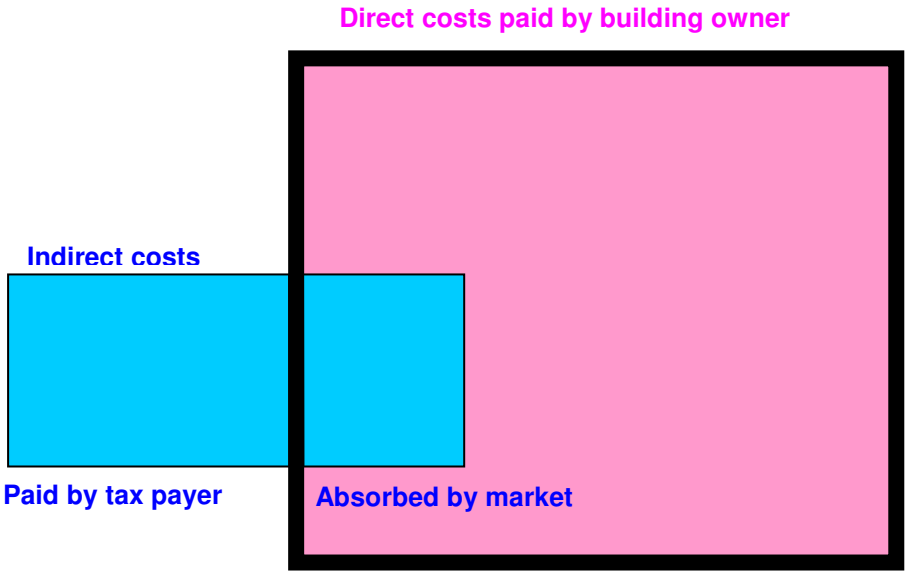


Figure 4. **Representation of the direct and indirect costs of energy certification**

1.2.1 Description of indirect costs

It is assumed that the activities in a scheme involving indirect costs will be as follows:

1. A government Ministry: The relevant Ministry will have ultimate responsibility for the scheme, authorise the 'rules' and decide how each activity will be organised eg whether by the public or private sector, the terms and durations of contracts to run such activities, etc. In some Member States more than one Ministry may be involved eg to cover the Residential and Non-residential building sectors.

2. The development of the certification scheme: this might include eg producing a written national specification for the methodology to be used and the format of energy certificates.

3. The central administration of the scheme: in principle this task could do everything but in practice it is more likely to have an overseeing and/or regulatory role.

4. Development of tools eg software: Member States might choose to have a single national calculation method (NCM) developed by one organisation which will be used for all certification (in specific sectors) or the methodology might be defined by a specification which can be satisfied by tools developed by 'the market'. A hybrid of these alternatives is also possible: eg where organisations can develop tools which get accredited as compliant with the NCM. It is likely that tools will need to be continuously maintained, periodically updated and improved. It is also probable that the tool developers will need to provide 'help desk' services to users.

5. Training and accreditation of experts: eg on the use of software tools, and in general on how to undertake an energy certification assessment of a building.

6. Quality Assurance (QA) and accreditation services: for example:

    a. Accreditation of software tools eg to check compliance with the NCM or national specification

    b. Accreditation of training courses

    c. QA of certificates produced by independent experts to ensure quality is maintained

    d. Verification of certificates produced by self-certification

7. Policing and enforcing services: there will be a need to ensure that building owners are complying with the energy certification laws and if not to enforce the laws by incentives and penalties, etc.

8. Data processing and analysis services: many countries are planning centralised databases to store energy certification results and so create an electronic national register of buildings and their energy performance. A special electronic register might be required to make the energy performance of public buildings directly accessible to the public. Such facilities will enable the energy certification scheme, including methodologies, benchmarks, etc to be periodically updated and improved on the basis of empirical data. It will also provide data on the energy efficiency of the national building stock (see Enper Exist WP3 Final Report on Building Stock Knowledge) and thereby inform the development of policies to achieve a phased improvement of building energy performance.

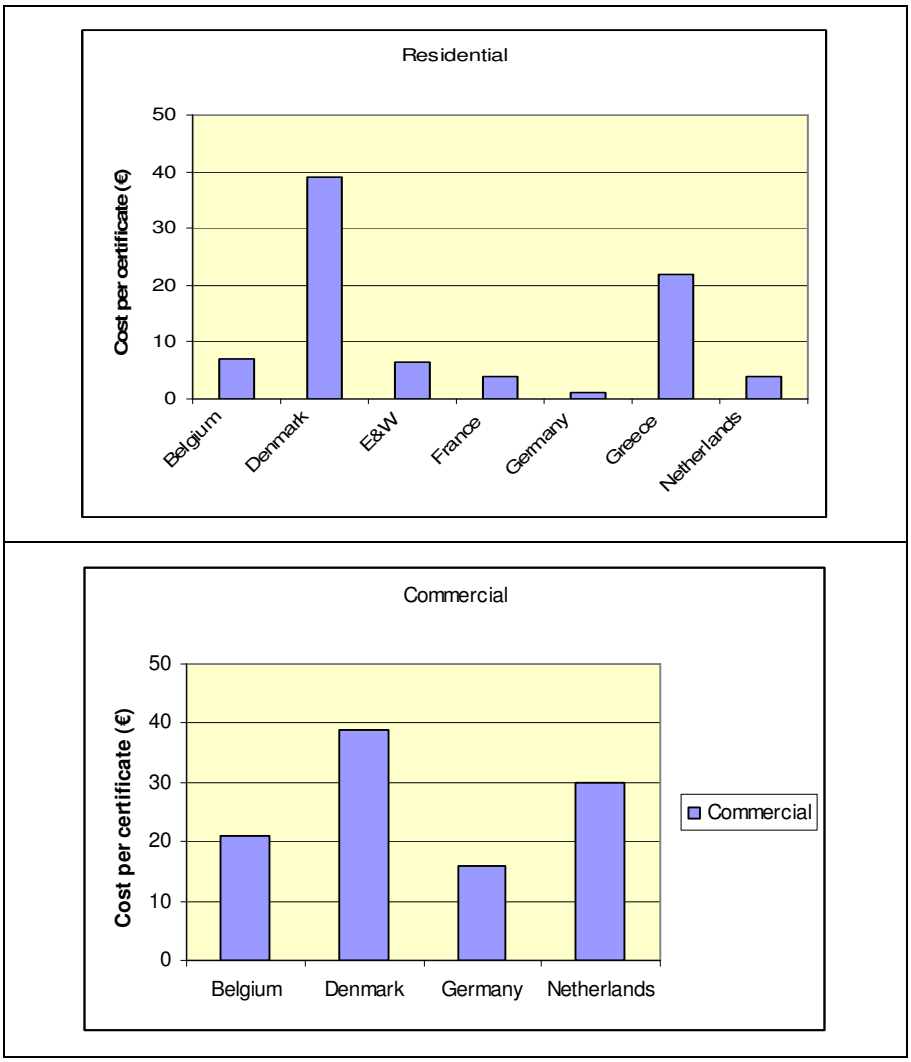
The direct cost involved in undertaking an energy certification assessment is assumed to encompass any energy certification service, for example, self-assessment via a web service, or the process of an independent expert being asked by a building owner to undertake the energy certification of their building, and all that entails in terms of site visits, data acquisition, report writing or form completion through to the procedure for the building owner receiving the energy certificate.

1.2.2 Calculation of indirect costs

A spreadsheet has been created which allows an estimate to be made of all the indirect costs involved in an energy certification scheme. Separate worksheets are provided for the Residential and Non-residential building sectors, partly also for the public building sector

1.2.3. Comparison of indirect costs in 7 countries

The overall effect of Indirect costs on building energy certification can be indicated by the estimated cost per certificate. This is shown in Figure 5 for each country in separate graphs for residential, commercial and public buildings.



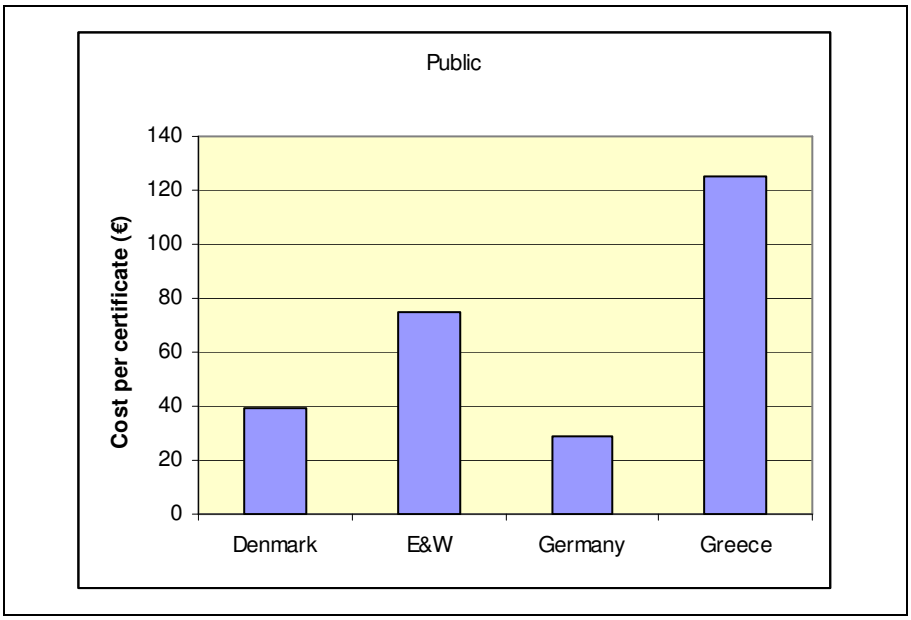


Figure 5 Comparison of certificate indirect costs in each country

1.2.4 Some Remarks on the Calculated Indirect Cost

The study reported here has illustrated a simple methodology for estimating the Indirect Costs involved in building energy certification schemes. The procedure has been applied to 7 countries, looking at residential, commercial and public buildings. The values for the input parameters have proved hard to estimate with any authority as only the schemes in Denmark are up and running. Furthermore, the arrangements for the organisation of certification schemes in other countries are still being developed and are unlikely to follow the Danish model. Nevertheless, the exercise has proved useful in identifying where the larger sources of cost are likely to arise and in showing potential peaks and troughs in different activities associated with certification such as training and accreditation of inspectors.

The overall conclusion is that the volume of the residential market is likely to ensure that economies of scale will prevail and indirect costs should be modest. In the non-residential markets, the volume is at least an order of magnitude lower so that indirect costs will inevitably be higher – it is less of a mass market. However, the non-residential market is already served by an existing cadre of energy professionals, whether as consultants, practitioners (engineers) or building and energy managers, so that the extra work involved in energy certification will not pose the same issues of creating a new profession and retraining people not familiar with the fundamental skills needed by energy inspectors. On the other hand, in Germany there is a new method for non-residential buildings, but the existing one for dwellings for which there is an existing cadre of professionals.

Finally, it must be emphasised that the estimated costs contained in this report should not be quoted outside of the context of the report's objective to illustrate principles. The report has not set out to generate accurate figures for costs.

1.3 The Impact on Labor

The more important impact of the certification process on labour is related to the creation of the new certifiers. In order to evaluate the number of certificates and of certifiers, different data are necessary: In particular:

- Knowledge of the building stock and the amount of transactions for each category of considered buildings:
    - Number of new buildings,
    - Number of building sold on yearly basis,
    - Number of building rented out on yearly basis

Moreover, in order to estimate a trend in the future, assumptions have to be made concerning the following elements:

- Increase rate for the new constructions,
- Increase rate for the number of sales,

The following elements have also to be taken into account:

- The validity period of the certificate

And also

The necessary time to establish a certificate for an existing building, and finally

The way and the procedure certification will be applied in each country.

All the participants have delivered data on all the above inputs. Various scenarios have been prepared in most of the countries regarding the procedure to introduce certification in the building sector. Generally, two scenarios are examined. One assuming a simultaneous introduction of the certification in the market and a second assuming a gradual introduction. Thus, the estimations in each country vary as a function of the assumed procedure.

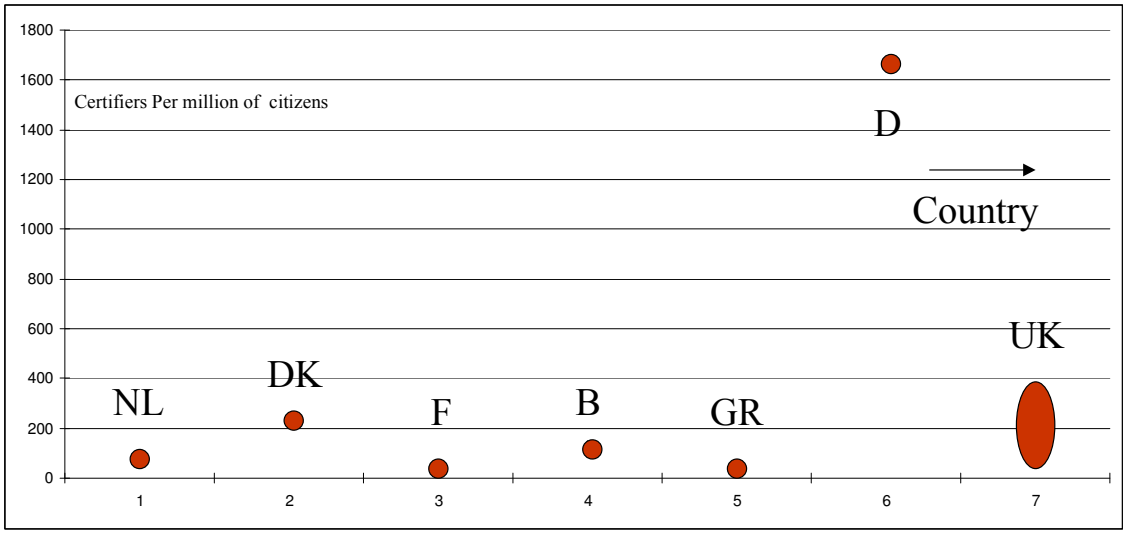
The estimated range of the number of certifiers per country is given in Table B1 of Annex 2. Data for France refers only to the required certifiers for the residential sector and does not include estimations for the tertiary buildings.

To allow comparisons between the member states, the range of the necessary certifiers per million of inhabitants has been calculated, (Figure 6).

As shown, for almost all countries, except Germany, the range of certifiers per million of inhabitants, is of the same order of magnitude. The mean range is around 85 to 250 certifiers per million. Germany, compared to the other countries, requires a very high percentage of certifiers.

However, almost 99 percent of the total are certifiers to be used only in the residential sector, and apparently are engineers or technicians certifying in parallel

Figure 6. Estimated Range of Required certifiers per million of inhabitants



systems and components of buildings, (boilers. A/C's, etc). This type of staff is not considered in the numbers given by the other countries. Thus, a direct comparison between Germany and the other participating countries is not possible.

1.4 Possible Economic Schemes to Finance the Application of the Certification Process

Introduction of the certification process in the market may need some economic stimuli. Although the certification process is mandatory, the member states may introduce economic measures to assist the easy penetration of the certification process. Financial schemes can be classified into two groups:

- Governmental financial incentives
- Non governmental activities

Governmental financial incentives could be given not only to get a certificate whatever the energy quality of building but only if a certain energy quality is reached in the considered building. Thus such a mechanism is no more focusing on all buildings but only on a specific category. Until now, few countries have an applied incentives to promote energy savings in buildings. Belgium has promoted tax reductions while the Netherlands until the end of 2003, the realization of voluntary energy audits in residential buildings, was combined with subsidies

There are different types of financial incentives that may be offered by governments, like :

- Direct subsidies to energy certificate paid to the end-user : The advantage of this system is that the direct cost of the certificate should be lower, while the major disadvantage is that, the cost of

the certificate could integrate the subsidy and become more expensive than without direct subsidy. A second disadvantage is that the total cost of the certificate has firstly to be paid before to benefit of the subsidy

- Direct subsidy to energy certificate paid directly to the experts. The advantage of this system is that the direct cost of the certificate should be lower and the disadvantage is that the cost of the certificate could integrate this subsidy and become more expensive than without direct subsidy

- Reduction of Taxes. The advantage of this measure is that not only new, rented or sold buildings are concerned. Also home-owner occupied buildings where no major renovation is made could benefit from this measure. The disadvantage of this kind of mechanism is that it is sometimes difficult to implement. Moreover, the effect of tax reduction is seen a few years after the expense. This measure has been applied in Belgium and it takes almost 12 to 18 months after the expense to have some results

- Reduced VAT rate on energy certificate. This kind of measure has the advantage to lower the global cost of the certificate, but it is probably difficult to implement/extend since reduced VAT rates have to be decided at the European level

- Specific guarantee for loan in case of certification. A way to promote the deliverance of energy certificates could be to attribute a reduced loan rate for building renovations according the recommendation given in the energy certificate. This mechanism may be coupled to the realization of a given minimum level of energy performance. This measure has the advantage to promote the realization of energy saving measures. There is not automatically a financial benefit for the energy certification. A benefit will only be observed if renovations are done. This will occur only a few years after delivering the certificate.

A set of initiatives could also come from non governmental organizations as for instance from the bank sector. This type of initiative would again probably be coupled to the realization of minimum level of energy performance of the considered buildings. Two types of non governmental financial incentives have been identified :

- Reduced loan rate for energy efficient buildings. As the certificate offers an excellent tool to judge of the energy quality of buildings, it could be used by the bank sector to offer reduced loan rate to energy efficient buildings or for major renovations involving a substantial improvement in the energy efficiency. The main advantage is the realization of energy saving measures, while benefits will only be observed if renovations are done. This will occur only a few years after delivering the certificate.

Subsidy schemes by energy distributors. The government may agree with theenergy suppliers to promote certification and energy savings.

In conclusion, two types of initiatives could enhance the application of the energy certification of building which are financial incentive and complementary mechanisms. The financial incentive can be governmental initiative or can come from the private sector. In general, some of the mentioned mechanisms would probably not only be linked to the deliverance of energy certificates but also to the realization of a minimum level of energy performance in the considered buildings.

The complexity, the required level of detail of the certification procedure as well as the required profile of the energy experts are determining the time needed to deliver one certificate and the direct cost of the system. Taking into account the maximum expected direct cost of the certificate from the very beginning of the development of the energy certification system could also play a role in the possibility to finance the whole system.

Task 2 : The Impact of Certification Process on Human Capital

The main objective of the present work package is to identify the nature and qualifications of the Certifiers, the necessary training effort, tasks, and responsibility and differential needs for the various types of buildings and finally the registration, accreditation and supervision schemes to be applied. Data and information concerning the specific tasks have been collected for all the participating countries.

2.1 The Nature and Qualification of the Certifiers.

To define the nature and the qualifications of the certifiers three main issues have to be considered : a) The Profession the certifiers, b) The prior education of the certifiers, and c) The specific expertise of the certifiers

The results of the survey show that certifiers in the Member States may have a background of architecture, design , structural building services and HVAC engineers, energy auditors and specialised assessors as well as energy distribution companies and environmental health officers. Different requirements apply in the Member States.

France and the Netherlands prefer specialized assessors; like energy or HVAC consultants, building services engineers and energy distribution companies. In Denmark, the qualifications of the certifiers will be engineers and architects. In Belgium, the preference is for engineers or architects .In Germany, in the field of residential buildings there is a big number of differently qualified certifiers like handicrafts, chimney sweepers, architects and engineers. All of them have to provide a proof for further education on that kind of work. For the non residential buildings only qualified planners are accepted. In all other countries, the profession of the certifiers is not yet decided.

Regarding the prior education of the certifiers, Countries ask for a technical education and a certain experience. In particular, in France, although is not yet decided, the requirement could be a combination of minimal general knowledge, minimal technical knowledge and minimal know-how. Concerning the specific expertise of the certifiers, some countries differentiate their demands according to the type of buildings. For housing, the requirements are more simple and experts with some experience on HVAC systems may fill the needs, while for large and more complex buildings, auditing skills may be necessary, while a very good knowledge of building physics is required. In particular in the Netherlands and in France both knowledge of building aspects and building installation aspects (hvac), are necessary. In Denmark, the energy consultant needs a minimum of 4-5 years documented, relevant experience in building technology and energy

consultancy. Finally, in Belgium, it is proposed to differentiate the expertise and the specifications for the certifiers of residential and large buildings

2.2 The Necessary Training Effort, Tasks and Responsibility and differential needs for the various types of Buildings..

As it concerns the necessary training effort to educate the certifiers, the main problems that have to be addressed are related to the existence of an official training programme by the member states and its characteristics, the characteristics of the training material as well as the characteristics of the body accredited to prepare the training material, the characteristics of the training body, the accreditation scheme to be followed in order to control the quality of the training procedure, and finally, the Quality Assurance System to be used.

Official and almost fully developed training programs have been developed in Denmark, Germany, the Flanders area of Belgium, in Denmark and the Netherlands. In Denmark, the accreditation scheme is divided into 3 different education's, targeting each of the building segments (small single family houses, blocks of flats - all sizes, and large public buildings (+1000 m²). In Germany, further education seminars in different technical disciplines are organised, with a size of in general 220 to 250 hours are the basis. Universities as well as academies for further education and associations will offer this kind of service. In The Netherlands, course material and courses have already been developed for the voluntary rating scheme for both residential and non-residential buildings. There are also various course institutes which already give this training having a minimum length of 4 days. In the Flanders area of Belgium, education/training is ongoing for the certifiers of the energy performance certificate of new buildings. Also the training and education of certifiers for the volontary evaluation of the energy efficiency of buildings (EAP) is ongoing. in UK, 'Train the Trainers', Training courses have already been run to describe what will be required by the new Regulations. In all other countries traing programs have not yet defined.

As it concerns the preparation of the training material, it seems that the member states will allocate this task to energy agencies, universities, accreditation bodies, to various experts, to commercial software providers, to professional institutions, or to local authorities. For most of the countries the preparation of the training material will be under the control of the state. As it concerns the accreditation of the trainers, it seems that this may be achieved through existing accreditation bodies. However, most of the countries have not foreseen any accreditation of the trainers.

Quality Assurance systems, (QA), to be used are of extreme importance. Three main QA categories have been defined : a) Registration of assessors, b) Certification or accreditation of companies and c) Accreditation of companies OR certification of assessors. In The Netherlands, the accreditation of companies system is going to be used, while in France the third system is more probable one. In UK, only accredited assessors will be able to issue an energy certificate based on an Asset Rating, while accreditation will be achieved by having the necessary qualifications, including passing an approved training course and exam. Training courses with the authority to accredit assessors will be approved by a central authority with national responsibility for the overall quality of energy certificates. The central authority will operate a quality assurance scheme to ensure the validity of energy certificates is maintained; for example assessments should be subject to random testing by an independent expert. The central authority will manage a register

of all energy certificates that have been issued and operate an associated database which will be used to monitor the energy efficiency of the building stock and to inform policy measures to improve it

Task 3 : The Impact of Certification Process on Human Capital

The main objective of this third work package is to identify the necessary structure and transformations that should happen to the national administrations in order to better support the application of the certification schemes in the countries. Two main issues have been considered :

- Identification of the new Structures to be created in the Member States
- Identification of Possible Actions to stress the certification process at a local level

3.1 New Structures in the Member States

The introduction of the Directive in the Member States requires new structures in the national administration. New main structures should belong to the central administration while sub sections may be decentralised at a local or regional level. New services may be classified in three main categories, and in particular in a) Preparatory Services, b) 2 Accreditation and Certification Services and c) Post auditing services.

3.1.1 Preparatory Services

Such a central service should have as main aim the validation of the whole procedure related to the introduction of the directive, (legislative issues, training, etc), as well as all tasks related to the Information and dissemination in the country. Thus, it may include two main services that may operate at a local or regional level :

- Service for the Supervision and Validation of the Certification Procedure
- Service on Information and Dissemination.

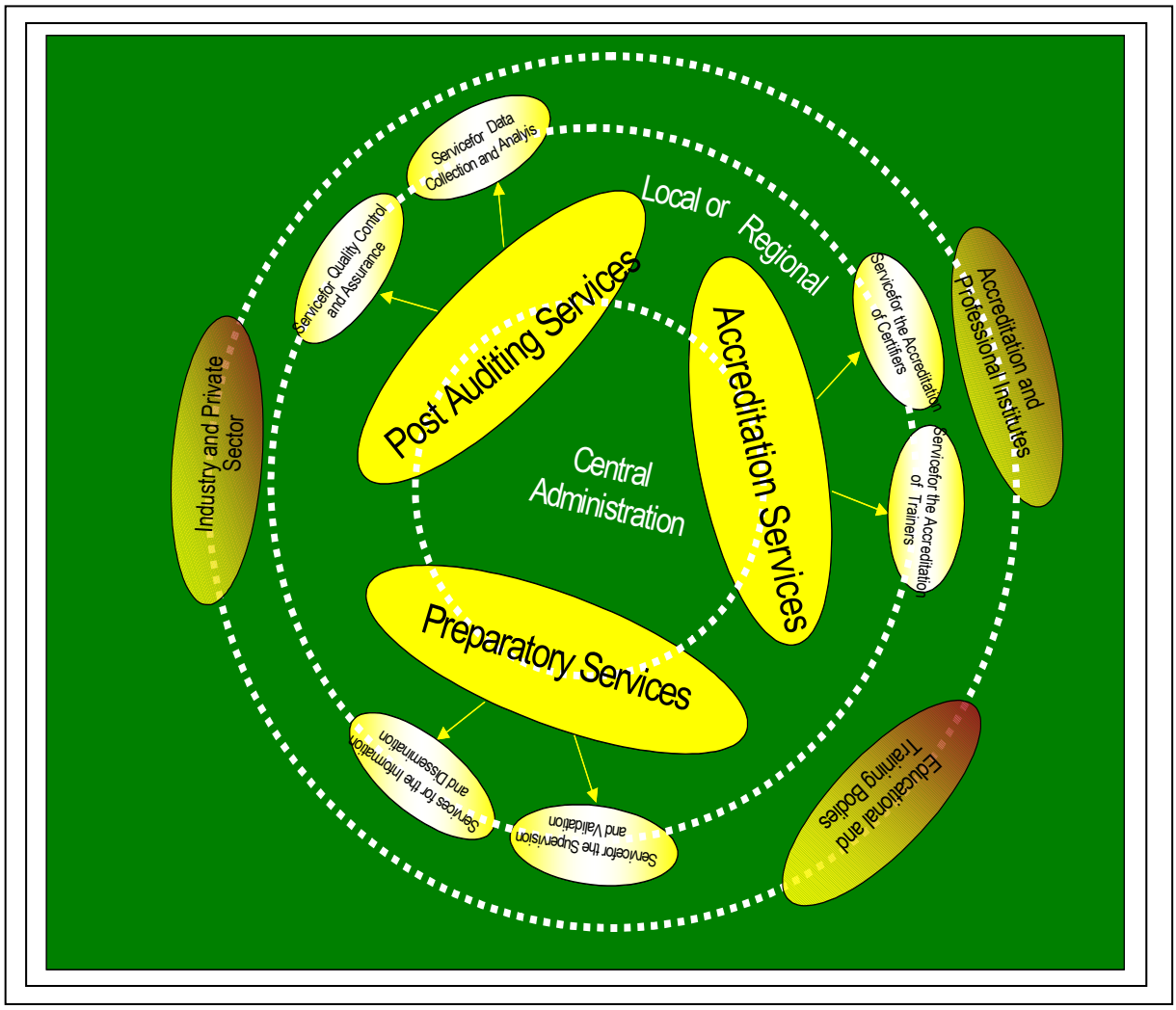


Figure 7. Possible New Structures in the Administration of the Member States.

3.1.2 Accreditation and Certification Services

Such a central service should aim to define, apply and supervise the accreditation procedure for both the certifiers and the trainers. Such a task may be undertaken in collaboration with accreditation bodies, professional institutions and other organisations in the country fully or partly responsible for accreditation. Thus, it may involve services for the accreditation of certifiers and possibly for the accreditation of the trainers, that may operate at a regional or local level :

Very important experience exist in France regarding the certification of persons or organisms and in the accreditation of companies. As it concerns the certification of persons or organisms, a three levels procedure as shown in Figure 8 is followed. In level 1 a certified person or organism delivers an 'energy performance certificate, while in level 2 a certification body delivers 'a certificate to a

person or organism‘ for his ‘Energy performance activity. Finally in level 3 an accreditation body delivers ‘an accreditation’ to an organism for his ‘personnel certification activity’, (Figure 8).

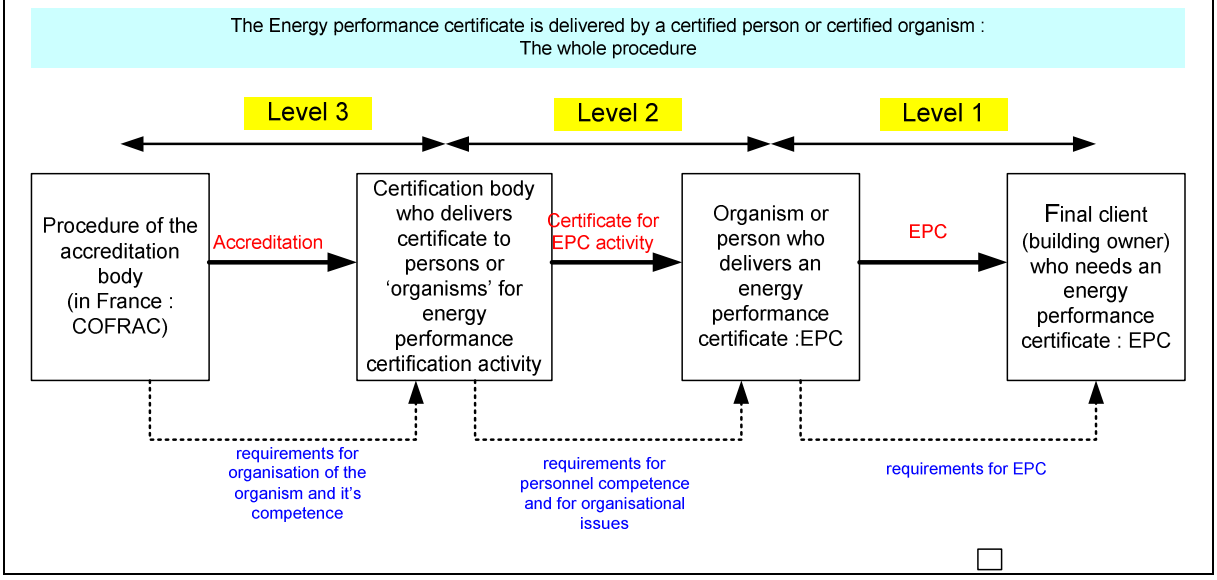


Figure 8. The three levels procedure for accreditation followed in France.

3.1.3. Post Auditing Services

Such a central service should aim to control and ensure the good application of the defined and agreed procedure and also to collect the energy related data analyse them and extract conclusions on the application of the directive. It may include two sub – services that may operate at a regional or local level . In particular :

- Service for Quality Control and Assurance
- Service for Data Collection and Analysis

Post Auditing Services have been applied in Denmark where there is a wide experience. The definition of "post-auditing services" includes collection of data from the labelling schemes and the quality control of these. In Denmark, ELO, the Energy Management Scheme for Large Buildings has been applied. The energy management scheme consisted of two parts, an energy label and an energy plan, which both have to be produced by an appointed ELO consultant.

The establishment of a coherent quality control has had a relatively high priority in the Danish Scheme. Experience obtained through the early years of the scheme showed that it is evident that energy labels and plans have a high level of reliability and uniformity, if the scheme is to gain ground in the sector.

The quality assurance consists of the following procedures/initiatives:

- random control of reports by inspections covering around 5 to 10 % of all reports
- quality assurance as result of enquiries
- external evaluations

The ELO Scheme has proved to be a suitable tool for raising awareness on energy and water consumption and reduction possibilities among owners of large buildings.

In most cases, owners have experienced that the yearly compulsory ELO inspection has delivered "added value" by pointing out methods and possibilities of saving energy and water (money!). Yet, there are also cases where the ELO requirements have been experienced as inappropriate. This includes, for instance, buildings where the energy and water demand is somehow predetermined and inflexible, as for instance showrooms with specific lighting requirements. The Danish experience shows that one should be careful to safeguard a positive perception towards the ELO scheme among building owners and hence not enforce legal requirements in cases where it is evident that there will be no added value in terms of saving

In parallel, In Denmark, an energy labelling scheme for small buildings has been applied. The scheme implies that all sold houses or apartments should be subject to an energy labelling so that buyers of the house receive information on the state of the energy installations, thermal installations and water consuming equipment of the particular house and further are being presented with suggestions on possibilities of saving energy and water

The energy labelling schemes have identified a large energy saving potential in existing building stock, savings which would be difficult to identify in other ways. Further, the energy labelling schemes have made a very large source of information on the present building stock in Denmark available, with the reporting of data from more than 45,000 one-family houses and 15,000 large buildings every year. This information is used in monitoring and evaluation of other policy initiatives and can be used to identify additional savings initiatives and policies. A number of important experiences concerning the set-up have been obtained during the existence of the two schemes.

This includes:

- First of all, it is evident that the schemes are designed so that they add value to users of the information/scheme, and they obtain benefits from their involvement/payment. This also means that the motivation among users is considered one of the most important factors for successful implementation. It is the attitude of Danish authorities that a rigid legal enforcement of labelling requirements might cause resistance and quite negative response among the users and hence ruin the implementation in the long run.
- Well structured dissemination of knowledge is important as information has to reach a quite large target group. To succeed with that, relevant carriers of information have to be pointed out, just as the information has to be informative and of a high quality. This also applies to design and contents of labels and reports, which have to target the users, i.e. be understandable but at the same time well documented and professionally presented.

- It is evident that a coherent quality assurance system work as an integrated part of a labelling scheme to ensure public acceptance. During the first years of the Danish Schemes, there were a couple of cases where the reliability of the schemes was questioned in the media. Partly as a consequence of this experience, the Danish schemes have subsequently been improved significantly in order to ensure that labels and plans are reliable and reproducible. Some of the most important instruments include measures addressing selection and training of consultants including establishing of training activities and measures addressing the outcome of their work such as random checking of reports, standardised software solutions including calculation principles, procedures for complaints, etc.

- One of the most important ways to ensure that the reports are reproducible is to define standard calculation principles. It is the experience of the Danish authorities that the principles of the calculation of energy consumption should be simplified as much as possible. It has been found that very complex methods do not raise the quality of the label, as detailed information on e.g. thermal conditions is not accessible during an inspection. Further, it is important that inspectors/consultants rely on their technical knowledge, insight and observations from the particular building rather than basing all conclusions on complex software.

- It could be recommended that a lot of effort is invested in designing software and database solutions. Internet on-line solutions have also turned out to be a very suitable way of improving working procedures and data handling.

Continuous adjustments of the scheme should be expected and must be considered already at the designing phase of the scheme. When setting up a labelling scheme, one should already from the beginning plan on carrying out evaluations which can be used in the continuous improvement of the scheme, administration, tools, dissemination, scope, etc. As part of this process, it is recommended that realistic and measurable goals and objectives are defined, and that the set-up is designed so that the impact can be evaluated.

Annex 1. Calculation of the Direct of the Certification Procedures for Residential and Tertiary Buildings

Country	NL	DK	F	B /Br	B/Wl	B/Fl	GR	D	UK
No of Residential Buildings / year (High)	500000	90000	2100000	70223	113940	175000	235346	2200000	568000
No of Residential Buildings / year (Low)	290000	90000	2100000	70223	7617	175000	125000	750000	100000
Cost Per certificate (high)	160	530	200	285	285	285	150	400	400
Cost Per certificate (low)	115	320	100	170	170	170	100	200	200
Direct Cost for Residential Buildings (High)	80000000	47700000	4.2E+08	20013555	32472900	49875000	35301900	8.8E+08	2.27E+08
Direct Cost for Residential Buildings (Low)	33350000	28800000	2.1E+08	11937910	1294890	29750000	12500000	1.5E+08	20000000
Population	15786000	5293000	59080000	10161000	10161000	10161000	10645000	82220000	58830000
Direct cost per capita (high)	5.1	9.0	7.1	10.1	10.0	10.0	3.3	10.7	3.9
Direct cost per capita (low)	2.1	5.4	3.6	4.2	4.2	4.2	1.2	1.8	0.3
Certified buildings / capita / year (high)	0.03	0.02	0.04	0.04	0.04	0.04	0.02	0.03	0.01
Certified buildings / capita / year (low)	0.02	0.02	0.04	0.02	0.02	0.02	0.02	0.01	0.00

Table A1. Calculation of the Direct of the Certification Procedures for Residential Buildings

Country	NL	DK	F	B /Br	B/Wl	B/Fl	GR	D	UK
No of Tertiary Buildings / year (High)	33000	10500	0	7314	6000	20800	13500	115000	104815
No of Tertiary Buildings / year (Low)	13500	5500	0	7314	1900	20800	9000	80000	12567
Cost Per certificate (high)	2000	5000	0	550	550	550	2000	2000	2000
Cost Per certificate (low)	1000	720	0	340	340	340	600	1000	1000
Direct Cost for Tertiary Buildings (High)	66000000	5,3E+07	0	4022700	3300000	11440000	27000000	2,3E+08	2,1E+08
Direct Cost for Tertiary Buildings (Low)	13500000	3960000	0	2486760	646000	7072000	5400000	80000000	12567000
Population	15786000	5293000	59080000	10161000	10161000	10161000	10645000	82220000	58830000
Direct cost per capita (high)	4,2	9,9	0,0	1,8	1,8	1,8	2,5	2,8	3,6
Direct cost per capita (low)	0,9	0,7	0,0	1,0	1,0	1,0	0,5	1,0	0,2
Certified buildings / capita / year (high) x 100	0,21	0,20	0,00	0,34	0,34	0,34	0,13	0,14	0,18
Certified buildings / capita / year (low)x 100	0,09	0,10	0,00	0,30	0,30	0,30	0,08	0,10	0,02

Table A2. Calculation of the Direct of the Certification Procedures for Tertiary Buildings

Annex 2. The Impact of Certification on Labor

Country	NL	DK	F	B/Br	B/Wl	B/Fl	GR	D	UK
Number of Total Certifiers (High)	1350	1200	3000	125	400	1025	550	136000	20696
Number of total Cerifiers (Low)	900	1200	1000	125	300	925	320	136000	2777
Number of Certifiers for residential buildings (high)	xxxxxxxxxx	xxxxxxxxx	3000	xxxxxxxxxx	350	685	450	135000	19572
Number of Certifiers for residential buildings (low)	xxxxxxxxxx	xxxxxxxxx	1000	xxxxxxxxxx	280	685	250	135000	1653
Population	15786000	5293000	59080000	10161000	10161000	10161000	10645000	82220000	58830000
ratio of Certifiers in the population/million citizens (high)	86	227	51	152	152	152	52	1654	352
Ratio of Certifiers in the population/ million citizens (low)	57	227	17	132	132	132	30	1654	47

Table B1. Estimated Number of Certifiers per country.