IMPACT
NATIONAL ENERGY PERFORMANCE CERTIFICATION TEST THE NETHERLANDS

November 2006

IMPACT

Improving energy performance assessment and certification schemes by tests

Report no.: IMPACT/13-14/2006/WP2.1
EC-contract: EIE/04/161/S07.38659
www.e-impact.org

Intelligent Energy Europe

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Date:
November, 2006

Report no:
IMPACT/ 13-14/2006/WP2.1

EC contract:
EIE/04/161/S07.38659

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Intelligent Energy Europe

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 were 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 six 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 six 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 into 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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Danish Building Research Institute (SBi) Denmark	
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In the Netherlands the Impact project had the following main objectives:

- Assess how home owners appreciate a draft energy performance certificate, its potential effect on the implementation of energy-saving measures by the home owners and the role of home owners in the assessment procedure.
- Examine the performance of an updated version of the EPA software and the tailored energy advice report and assess the time required for EPA advisors to complete the various components of the assessment process.

The test has focused on residential owner occupied dwellings.

Conclusions

- The certificate clearly helped home-owners understand and become aware of the energy performance of their houses. One quarter of the home-owners also intended to implemented energy-saving measures on the basis of the certificate.
- Most home owners regarded the energy performance certificate as useful and as potentially being a factor when the house is to be sold, although the importance of the certificate in this respect was generally regarded as subordinate to that of other characteristics of the house.
- The supplementary tailored energy performance advice (EPA) is seen as an instrument that gives added value to the energy performance certificate by providing information that is needed to actually make an investment decision in energy-saving measures. The financial basis for the tailored advice however is limited (people willing to pay for it).
- Home-owners are able to contribute to the home assessment by supplying a set of data that can help reduce the advisors' assessment time and thus reduce costs. Information on surface areas and levels of insulation however can not be supplied with acceptable accuracy by the home owners.
- The approach of using a simplified energy performance certificate that can be supplemented by a voluntary tailored energy performance worked and was appreciated by home owners.
- The procedure for composing sound and comparable sets of tailored improvements measures can be improved.

Recommendations for national EPBD implementation

- The energy performance advice report was regarded as a supplement to the certificate. It is recommend that the EPA report also includes information on

the current energy label of a house and the label that could be achieved by implementing energy-saving measures.

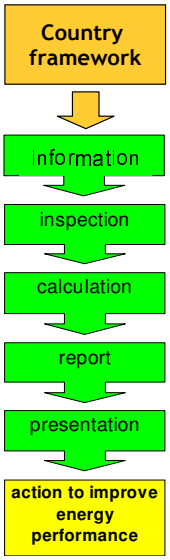
- Recommendations have been made for improving the training, software and handbook/manual for experts regarding the composition of sound sets of improvement measures.
- It is recommended to link the voluntary energy performance advice to specific incentive measures in order to stimulate its penetration in the market.

Recommendations for other countries

- Training, software and handbooks should provide good support for the selection of sound packages of improvement measures. Sound in terms of building physics, economics (the right order of pay back time) and tailored well to the specific building.
- Quality control in the form of central validity checks and/or (random) on-site inspections can be important mechanisms to ensure the quality and credibility of the certification system. The information collected and analysed enables a feedback loop for periodic improvement of training, software and handbooks.
- Set a maximum pay back time criterion for composing sets of advised improvement measures (e.g. a maximum of 10 years) to increase the follow-up potential of the advice (people actually improving their homes).
- Distinguishing a simple and concise mandatory certificate (label and standardised list of measures) from a supplementary tailored advice (including investment cost and pay-back times) as a decision document could help in addressing the different interests of addressees (seller and buyer of a home) with the appropriate information.
- If the financial basis for a tailored voluntary advice procedure is low (people not willing to spend money for a proper advice) it should stimulated with effective incentive measures.
- As personal advice on improvements is regarded as important by home-owners it is recommended to develop (or stimulate the development) of follow-up services that guide home-owners to experts that can give a tailored and personal advice on home improvements.

1 Introduction

One of the objectives of the IMPACT project is to develop a European good practice model for energy performance certification. This model is composed of a set of good practice guidelines covering all essential process steps for energy performance certification.
The EU directive on the energy performance of buildings (EPBD) is implemented throughout Europe in many different ways depending on the national framework.
Hence, in order to be able to derive good practice guidelines on energy performance certification for European countries, each of the national tests needs to be evaluated in relation to the national framework conditions.
Therefore the national reports on the national Impact tests are split in chapters each covering a process step, starting with a description of the national context for this process step.



Chapter 2 describes the status of EPBD implementation in the specific country and the role of the Impact test in the national implementation process. Chapter 3 gives an overview of the status and (planned) activities regarding informing stakeholders and the public on energy performance certification. In chapter 4 the building structure for the specific country is described as background for the EPBD certification approach chosen in a country. Chapter 5 covers the building inspection as part of the certification process. Chapter 6 describes the calculation methodologies used for energy performance certification. In chapter 7 the approach for the certificate, additional tailored advice reports and the appreciation of the end-user are described. Chapter 8 covers the approach and the perceived needs for presentation of certificates or advice reports to the building owner. In chapter 9 the results of use enquiries aiming at assign the potential impact of energy certification on energy savings in the built environment, the primary goal of the EBD, is described. The reports end with overall conclusions and recommendations (chapter 10).

As stated before, the EPBD is implemented throughout Europe in many different ways depending on the national framework. Within the Impact project all participating countries have therefore chosen their own specific focus and approach for the national IMPACT test that fitted the specific needs in the national context.

In the Netherlands the Impact project had the following main objectives:

- Assess how home owners appreciate a draft energy performance certificate, its potential effect on the implementation of energy-saving measures by the home owners and the role of home owners in the assessment procedure.
- Examine the performance of an updated version of the EPA software and the tailored energy advice report and assess the time required for EPA advisors to complete the various components of the assessment process.

The test has focused on residential owner occupied dwellings.

2 EPBD implementation and role of Impact

2.1 EPBD Implementation in the Netherlands

2.1.1 Background, previous experiences

New buildings: All new buildings need to be built according to the EPC requirements in the Building Code. The EPC Energy Performance determination method is based on the national standards NEN 5128 and NEN 2916 and is operational as part of the building code since 1995.
A standard calculation showing that the Energy Performance Coefficient (EPC) of a new building meets the maximum value set in the building code is a mandatory part of the building permit; for the moment there is no energy certificate coupled on this Energy part of the building permit.
The EPC calculation method determines an energy performance coefficient (EPC) which represents the primary energy consumption of the building, independent of the building geometry. A maximum EPC value is enforced by the building codes. This value is lowered periodically, thus strengthening energy performance requirements.

Existing dwellings: The EPA-W process was introduced in 2000 as a voluntary policy instrument aimed at stimulating home owners to take energy efficiency and renewable energy measures. Within the method the energetic quality of an existing dwelling or complex of dwellings is calculated. The resulting energy index is independent of user behaviour. The energy advice however does include user behaviour by taking into account the measured use of natural gas and the dwelling occupation. Advice is given for possible improvements (measures, financial effects, and payback times). Only EPA's executed by certified consultants were eligible for subsidies (subsidy for the EPA itself and for the proposed measures).
The calculation method determines the energy consumption for space-heating, domestic hot water and electricity for fans and pumps. Renewable energy sources are also taken into account, such as passive solar energy, solar collectors, photovoltaic panels, heat recovery, and heat pumps. Based on the primary energy consumption under standard indoor and outdoor conditions, an energy performance index is then calculated, known as the Energy Index (EI). The EI is defined in such a way that it is independent of the housing geometry and the user behaviour. This means that the EI is only determined by the energy quality of the building. A large villa can therefore have the same EI as a small apartment, as long as their energy quality is the same (same level of insulation, same installations etc.). EPA-W has been introduced for individual homeowners as well as for social housing and commercial apartment building owners (multifamily housing).

2.1.2 Current legal status EPBD

Source: Country review EPBD buildings platform PO07, 28/8/06 [BP 2006].

The implementation of the Energy Performance of Buildings Directive in The Netherlands falls under the responsibility of the Ministry of Housing, Spatial Planning and the Environment. On November 1st 2005 the Dutch government notified the European Commission on the status of the implementation of the EPBD in the Netherlands. The Netherlands fully underlines the importance of the EPBD and strives for a full implementation of the Directive. The Dutch government aims at complete implementation of the EPBD in the Netherlands, from January 1st 2007. The first step is the training and accreditation of assessors or inspectors who will then be qualified to issue the Energy Performance Certificate. Once the Netherlands has sufficient qualified inspectors, the Energy Performance Certificate will become mandatory for every transaction in the building sector.

The Netherlands already meets the Directive on a number of issues. The missing issues are being adapted and incorporated into Dutch law (Article 7 - Energy performance certificate), or measures are brought under the attention of the end-users via another route (Article 8 - Inspections of boilers and Article 9 - Inspections of air-conditioning systems). Like the European Union, the Dutch government has an active policy to keep the administrative costs for citizens minimised. For this reason, the costs for obtaining a certificate are kept to a minimum.

Calculation procedures

Currently a substantial part of the EPBD has already been integrated into the Dutch law.

Article 3, the methodology for new buildings already complies with the current Energy Performance Standard (EPN). For the existing building stock the actual Energy Performance Advice (EPA) methodology is being simplified. As a result, the calculation procedures for this will be ready before the end of 2006. A quality assurance system will also be ready by the end of 2006.

Article 4, setting of energy performance requirements for new buildings, complies with the Dutch Energy Performance Standard (EPN). The same methodology applies to major renovations of existing buildings. Part of the Energy Performance Standard for new buildings (and major renovations) is the calculation of a so-called Energy Performance Coefficient (EPC), since 1995.

Table 1 gives an overview of the many aspects that are covered within this EPC calculation for new buildings.

Table 1: Overview of the aspects covered within the EPC calculation for new buildings.

		residential		non-residential	
		minimum	EPC	minimum	EPC
Heating	U-Value (Roof, Walls, Ground)	R_c =2,5 m^2K/W	x	R_c =2,5 m^2K/W	x
	U-Value (Windows, Doors)	4,2 W/m^2K	x	4,2 W/m^2K	x
	Air tightness	0,2 m/s	x		x
	Passive solar gains		x		x
	System efficiencies		x		x
Cooling	Area of transparent elements		x		x
	Overheating (time, Δtemp)		x		x
	Solar Gains		x		x
	Shading of windows		x		x
Ventilation	System efficiencies		x		x
	Air change	0.9 dm^3/s per m^2 floor	x	function related	x
	IAQ requirements	Minimum requirements from the Building Decree	x	Minimum requirements from the Building Decree	x
	Heat recovery		x		x
Lighting	Installed power (W/m^2)		x		x
	Daylighting	m^2 of windows > 10% of floor area	x	m^2 of windows > 2,5 - 7 % of floor area Function related	x
Hot Water	Consumption		x		x
	Solar Gains		x		x
	System efficiencies		x		x
Other	Co-generation		x		x
	District Heating/cooling		x		x
	Renewables		x		x
	Other: Photo Voltaic cells		x		x

In the column "EPC" the "X" mark means that this aspect is part of the calculation of the Energy Performance Coefficient (EPC).

Minimum requirements for new buildings and major renovations

In the current national building regulations, proof that the requirements are met must be given before the completion of the building. Verification of this legal provision is the responsibility of the Local Authority where the building is located. The main requirement is to comply with a given maximum value for the Energy Performance Coefficient (EPC). In table 1, additional requirements are shown.

Requirements for existing buildings

Regarding Article 6, Existing buildings, the Dutch Building Law ensures that in case of a major renovation a minimum level of energy performance is met. For small renovations there are minimum requirements concerning ventilation and insulation.

Certification of buildings

The issuing of the Energy Performance Certificate is established in the 'Decree Energy performance of Buildings' (BEG). The BEG was approved on June 30th 2006 by the Dutch Council of Ministers and is currently for advice at the Council of State. Also, the Certification for buildings with a total useful floor area over 1000 m^2 occupied by public authorities (Article 7.3), is allowed for in the BEG. However, the Netherlands has decided not to set or apply this requirement for the categories of buildings that are named in Article 4.3. The Dutch government will display the Certificate in all of its buildings that are accessible to the public. Schools and health-institutes will not have to comply with Article 7.3 of the Directive because these services are not the responsibility of the Dutch government. In the 'Regulation on Energy Performance of Buildings' (REG) that is to be issued in 2007, the above will be developed in further detail. In the REG the representative requirements of the Certificate will be outlined, as well as the required minimum information on the Certificate. The REG has been sent to the European Union for notification in September 2006.

Inspection of boilers and air conditioning

In the Netherlands small boilers are usually checked every year for maintenance reasons. The number of boilers fired by non-renewable liquid or solid fuels is rapidly decreasing. In future the energy performance of the boiler will also be taken into account in the yearly inspection. For this a tool will be developed with which the energy performance of the boiler can easily be determined.
For large boilers the Netherlands complies with current legislation in the Environmental Law.
The system that the Netherlands will implement for small boilers will lead, with regard to the inspection issues as described in the directive, to the intended result on the basis of both a voluntary scheme and legislation. Maintenance and, if needed, advice to replace the boiler will be encouraged by means of a national public information campaign which will start before the 2006 / 2007 heating season.
The approach to air conditioning systems (Article 9) will be developed similarly to the above described method for boilers (Article 8).

2.1.3 Transposition planning (time schedule)

The Netherlands are striving for complete implementation of the EPBD by January 1st 2007. The formal obligation to comply with the Directive will be met as soon as there is a sufficient number of qualified and accredited inspectors for the Energy Certificate**.**

2.1.4 Introduction to planned EPBD approach

The implementation of the EU Directive on the Energy Performance of Buildings (EPBD) in the Netherlands will make it compulsory to present an Energy Performance Certificate (referred to below as EP certificate) to the new owner or tenant of any house that is sold or rented out. The Dutch government has decided to introduce a simple and concise mandatory EP 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 tailored advice goes further than the planned EP certificate, which only shows current energy performance and offers a standardised list of cost-effective improvement measures.

2.1.5 Planned approaches for specific building types

The planning of the formal obligation to comply with the Directive is January 1st 2008 at last. No decision about an approach for specific building types has been made yet.

2.2 IMPACT test in The Netherlands

2.2.1 Objectives of the Impact test

Originally it was planned that new tools and procedures for energy performance certification would become available in The Netherlands end of 2005 as part of the Dutch national translation process of the EPBD. Within IMPACT these tools and procedures would be tested in practice as part of the national EPBD implementation.

In August 2005 the Dutch government however decided to postpone the implementation of the directive. In the light of this national status, in spring 2006 it has been decided to contribute within IMPACT to the development of EPBD implementation in The Netherlands with the following objectives:

- Assess how home owners appreciate a draft energy performance certificate, its potential effect on the implementation of energy-saving measures by the home owners and the role of home owners in the assessment procedure.
- Examine the performance of an updated version of the EPA software and the tailored energy advice report and assess the time required for EPA advisors to complete the various components of the assessment process.

More specifically the following results were pursued:

1. Appreciation by home owners of trial EP certificate and the new EPA reporting system, and the potential effect in terms of stimulating home owners to take measures
2. Experience with the new version of the EPA software
3. The time EPA advisors take to complete the various components of the process
4. Critical quality assurance aspects of energy performance certification
5. Potential contributions to house assessments by home owners

2.2.2 Support to national EPBD implementation

For the implementation of the EU Directive on the Energy Performance of Buildings (EPBD) in the Netherlands the Dutch government has planned to introduce a simple and concise mandatory EP 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 tailored advice goes further than the planned EP certificate, which only shows current energy performance and offers a standardised list of cost-effective improvement measures.
Within the Impact test this approach is tested in practice and provides feed-back for the final design of the implementation in The Netherlands.

2.2.3 Test approach

For approximately 100 households, EP certificates and EPA reports have been produced by a group of certified energy advisors. Before the energy performance assessment by the advisor, the home owners were asked to perform a self-assessment of their house in order to evaluate the potential contribution of residents to EP assessments. All households received an assessment form for this task. The purpose was to identify ways of reducing the costs of EPA and EP certification.
After the self-assessment form had been returned, an energy advisor performed an energy performance assessment. The data acquired in both assessments were compared to assess their validity. Based on the energy performance assessment, an EP certificate and a tailored EPA report were compiled.
The residents received both documents in one package, together with 2 questionnaires, one to assess their appreciation of the EP certificate and one for the EPA report. Home owners were asked to process both documents and questionnaires independently and in the correct order, i.e., first that regarding EP certificate and then that regarding the EPA report. After a substantial percentage of the questionnaires had been returned, they were processed to analyse the feedback provided by the home owners.

3 Information campaigns on EPBD

3.1 Information strategies in the Netherlands

3.1.1 Past experiences with information campaigns, enforcement and coverage

Information and promotion of the voluntary EPA scheme
Until the end of 2003 the voluntary EPA scheme was subsidised. For measures (i.e. solar water heaters) an additional investment subsidy was available when an EPA was conducted and the measure was advised.

Municipalities were stimulated to promote EPA's as a result of a National Climate Covenant between the government and the municipalities. A goal has been set for municipalities to stimulate that 30 % of the existing building stock receives an EPA. A climate policy subsidy for municipalities is linked to this goal. As a result several municipalities execute(d) EPA-campaigns. EPA's have also been embedded in RUE and solar water heater/ PV campaigns due to the extra investment subsidy for measures when an EPA was conducted.

A similar covenant has been closed between the national government and the social housing sector (housing associations). A similar goal of 30 % EPA has been set. Drivers for housing associations are/were: preparation for the introduction of the EPBD; it was free due to the subsidy; required in order to get extra investment subsidy for measures; as useful planning tool for renovation and maintenance projects; as basis for embedding energy quality in building stock asset management.

National promotion by ministry of VROM (television commercial, web-site) and SenterNovem (support to market actors and municipalities).

The EPA programme led to the development of an infrastructure of EPA consultants/companies. These consultants/companies, among which large utilities, have organised their own promotion.

Penetration results after 5 year promotion program:

- Private homeowners: limited penetration of 1.6 %; interested mostly when additional subsidy for measures could be received; mostly reached in campaigns organised by municipalities / utilities.
- Tenants have not been targeted directly
- Housing associations: penetration of 22.5 % in 5 years (in total 540.000 EPA's).

3.1.2 Actors involved in EPBD roll-out

The ministry of Housing (VROM) is responsible for the implementation of the EPBD in the Netherlands. SenterNovem is supporting VROM in developing the scheme for EP certification and in carrying out the dissemination of EPBD information to specific target groups.
Stichting KBI is responsible for quality assurance by developing a certification scheme, together with market actors. Based on this scheme the certification institutes will certify the experts. Complementary the Dutch Accreditation Council has to acknowledge both the certification scheme and the individual certification institutes.
In addition to this VROM implemented a regular consultation of market actors by means of a feed back group.

3.1.3 Planned information programs

The information campaign will start addressed to expert groups in the beginning of 2007, including a special EPBD website. A broader (TV and radio) campaign to building owners will start in the second half of 2007.

3.1.4 EPBD enforcement, penalties

Nothing has been decided yet on this issue.

3.2 Information strategies in the IMPACT project

The houses to be assessed within the test were selected from those addressed in a campaign for the promotion and implementation of energy-saving measures by home owners in the region around the Dutch town of Leiden (a campaign called '*Servicepunt Warm Wonen*'). The campaign was set up by the municipal authorities of the towns of Leiden, Leiderdorp, Oegstgeest, Warmond and Zoeterwoude, and the *Regionale Milieudienst West-Holland* (West-Holland regional environmental service).
The test was announced in a newsletter distributed by the campaign office to home owners in the relevant region in the autumn of 2005. About 250 home owners expressed an interest in participation. In 2006, the home owners were

asked to confirm their application, stating the type of house they owned. In the end, 143 owners applied, of which100 were selected on the basis of house type and geographic distribution (to avoid more than one house of the same type being selected per street).

After the assessments had been completed, all participating home owners were sent a questionnaire asking their opinion on the EPA certificate and the tailored EPA report. On 1 September 2006, 64 questionnaires had been returned by home owners, two of which were invalid. The analysis was thus based on 62 questionnaires. In view of the limited sample size, we opted for a simple form of processing by means of Excel software.

In addition to the 84 energy performance assessments on houses selected via the campaign office, EPA reports and trial energy certificates were also produced for 10 houses which were being sold by two estate agents in the Leiden region. In this procedure, the estate agents assessed some of the house data.

4 Building structure

4.1 National building structure

Fifty-two percent of homes in the Netherlands are owner-occupied. The remaining houses are rented out by not-for profit housing associations or private landlords (36% and 12%, respectively). Almost 90% of the owner-occupied homes are single-family dwellings, which can be classified as terraced houses (48%), detached houses (30%) and semi-detached houses (22%). Forty-one percent of the existing housing stock were built before 1966, 41% in the 1966–1988 period and 18% after 1989 [KWR 2000].

In 2002 the building stock consists of 6.71 million houses, of which 71% one-family houses and 29 % multi-family houses [COW 2004].

Table 2: Year of construction residential buildings (distribution of building ages), 2002 [COW 2004]

Tot 1945	'45-'59	'60-'70	'71-'80	'81-'90	1991 or later
22 %	12 %	18 %	18 %	16 %	14 %

Table 3: Ownership distribution, 2002 [COW 2004]

Owner occupied	Commercial rent	Social rent
35 %	11 %	54 %

Table 4: Number of residential buildings built each year [COW 2004]

1997	1998	1999	2000	2001	2002
92.314	90.516	78.625	70.650	72.965	66.685

- No. of residential buildings sold yearly
  In 2000-2002 524.000 people are moving in the private home owner sector. The main part is buying a new house moving and some of them are starters. This correspond to approximately to 262.000 sold residential buildings each year [COW 2004].

- No. of buildings/ (apartments) rented each year (tenant change)
  In the rent sector 583.000 people moved in 2000-2002. This amounts to 291.500 dwellings a year [COW 2004].

- Non-residential buildings
  No. of non-residential buildings is approximately 300.000. There is no specific information available about the percentage of owner occupation and renting.

- Conclusions regarding EPBD implementation, expert infrastructure capacity needed.
  The Dutch government expects that there has to be a capacity of at least 1.000 experts for both residential and not-residential buildings.

4.2 Buildings and respondents in IMPACT test

The target group for the Dutch IMPACT test consisted of private home owners owning a single-family dwelling.

Respondents registered through the home-owner campaign

- Almost 80% of the respondents were aged 50 years or over.
- Detached houses were underrepresented (11%), while terraced houses were overrepresented (71%)[1], see figure 1.

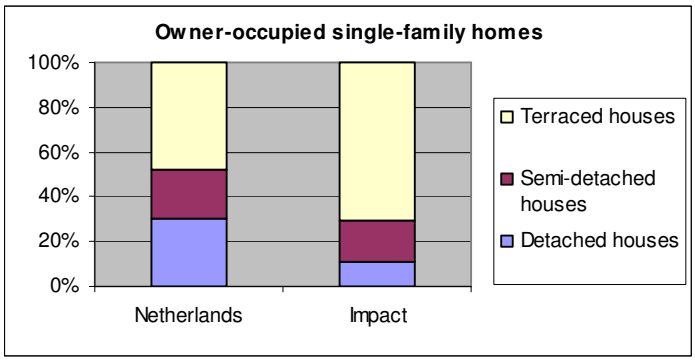


Figure 1: Respondents owner-occupied single family homes

- Houses built in 1966-88 were overrepresented (57%), while those pre-1966 and post-1989 were underrepresented (34% and 9%, respectively), see figure 2.

[1] Percentages based on data stated by respondents in their applications.

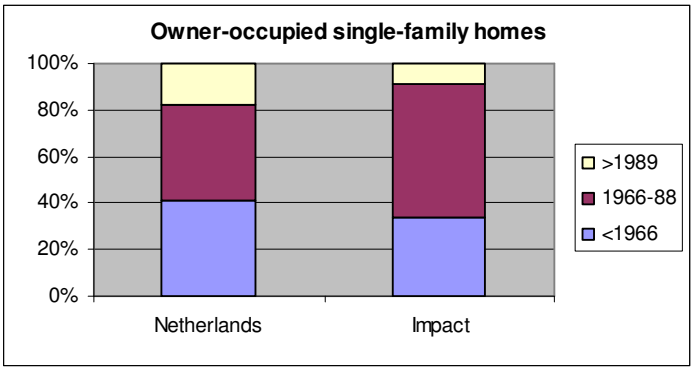


Figure 2: Breakdown owner occupied single family homes in years

- Over 90% of respondents regarded energy saving as important enough to adapt their heating and ventilation habits where possible (53%), or even to make major investments in addition to changing their habits (39%).
- Eighty-five percent of respondents indicated they had already implemented energy-saving measures in the past (the three most frequent measures being window insulation (double glazing or highly insulating glazing), high-efficiency boilers and water-saving shower heads or flow limiters on taps).
- Sixty-four percent of the houses had an energy label of D or better. The median label of the existing housing stock in the Netherlands is between D and E, which means that 50% of the Dutch houses have a D label or better. The test sample included relatively few houses with F or G labels (figure 3).

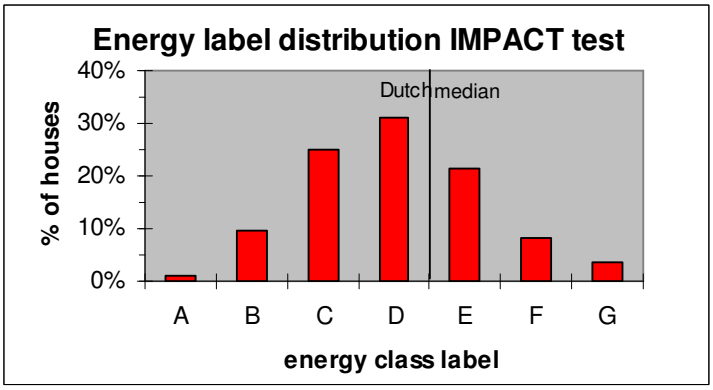


Figure 3: Overview of energy labels

- Only 8% were unfamiliar with any form of compulsory energy labelling (such as those for household appliances, cars, lighting, etc.). The most familiar energy labelling system (with 90%) was that for household appliances, followed by those for lighting and cars (60%).
- Twenty-six percent had been aware before taking part in the test (or receiving information about the test) that a compulsory EP certificate for houses was going to be introduced.

The group of respondents was not fully representative for the existing Dutch housing stock or home owners, which is not surprising since the sample of 100 home owners was selected from those interested enough to apply for the test. This must be kept in mind when evaluating the results of the test.

5 Building inspection

5.1 National overview building inspection

5.1.1 Expert/auditors capacity needed

The Dutch government aims at complete implementation of the EPBD in the Netherlands, from January 1st 2007. The first step is the training and accreditation of assessors or inspectors who will then be qualified to issue the Energy Performance Certificate. Once the Netherlands has sufficient qualified inspectors, the Energy Performance Certificate will become mandatory for every transaction in the building sector. The Dutch government expects that there has to be a capacity of at least 1.000 experts for both residential and not-residential buildings.
In the current voluntary Energy Performance Advice (EPA) scheme approximately 200 full time units (FTU) of experts are available. For EPBD implementation approximately 1000 FTU's are required. In 2004 more than 130 certified expert companies were registered.

5.1.2 Specific past experiences

Quality control in EPA-W scheme for existing dwellings
In 2002 the Council of Acknowledgement agreed to a final version of a process certification system for energy audit companies for dwelling (BRL9502). With these final terms the five certification institutes, established in the Netherlands, could officially start certifying EPA companies.
For the following topics quality requirements are set in these final terms for certified EPA audit companies:

1. The advice (the EPA-report, the use of certain EPA-software, monitoring file);
2. The process (scope, assignment, preparation, inventory of recent situation, choice of energy saving measures, delivering advice);
3. The company (registered with the Chamber of Commerce, third-party insurance against damage following the giving advice (in so far as this damage is attributable to the advice), personnel, tools and instruments);
4. The internal quality control (general, quality handbook, quality policy, responsibility/competence, internal quality chart, description of procedures, requirements of procedures);
5. The external quality control (access procedure, follow-up controls, dealing of complaints by certification institute);
6. The process certificate.

The certification institutes check randomly chosen projects. The number of checks depends on the number of EPA's reported.
The minimum educational levels for experts of the EPA scheme are (this level is required for at least one person of an EPA consultancy company):

- Level of basic education:
  - 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.
- Level of additional training:
  - Training for EPA consultants given by one of the recognised training centres.
- Experience:
  - Several years' experience in the field of energy conservation techniques (knowledge of matters relating to comfort and indoor environment is a must).
  - The EPA consultant must also have advice skills (communication, anticipate on the wishes of the client).

The consultants do not have to be certified themselves, the organisation however has to be certified based on the process certification scheme. As described above at least one of the consultants needs to meet the minimum requirements on education and experience. In practice this can result in EPA's done by under qualified persons.

Quality control in EPC scheme for new buildings
For the EPC scheme no quality certification scheme has been implemented. Certification of the consultants is not mandatory, but wanted. Currently the municipality is responsible for assessing the quality and completeness of the building permit request submitted, including the obligatory energy certificate calculation. In practice it occurs that the available capacity in time and knowledge with regard to checking the energy certificate calculations submitted is varying between municipalities and at times too limited.

5.1.3 National quality control infrastructure

In 2005 the ministry of housing has started a development for updating the existing process certification system for energy audit companies for dwellings (BRL9502) and the draft for non-residential buildings (BRL9503) with the goal to meet EPBD criteria and improve the quality of the process certification system. Draft terms were published and made public for feedback. This new quality assurance system (BRL9500) should be ready by the end of 2006.

- Regular checks will randomly be made by the certification institutes. The number of checks will depend the number of EP certificates reported.

- For the experts it will be mandatory to report the information of the EP certificate to a central database.
- The experts will be certified by certification institutes. The certification scheme is developed by Stichting KBI. The certification institutes will be certified by the Dutch Accreditation Council.

5.2 Building inspection in IMPACT test

5.2.1 Approach

For 94 households, EP certificates and EPA reports have been produced by a group of certified energy advisors. 84 have been selected through the regional energy saving campaign for home-owners (Servicepunt Warm Wonen) and 10 through 2 real estate agents in the region of Leiden. Before the energy performance assessment by the advisor, the home owners were asked to perform a self-assessment of their house in order to evaluate the potential contribution of residents to EP assessments. All households received an assessment form for this task. The purpose was to identify ways of reducing the costs of EPA and EP certification. After the self-assessment form had been returned, an energy advisor performed an energy performance assessment. The data acquired in both assessments were compared to assess their validity. Based on the energy performance assessment, an EP certificate and a tailored EPA report were compiled.

5.2.2 Building assessments by home owners

The test involved home owners contributing to the energy performance assessment of their houses by recording some of the details of construction and installations themselves and by supplying construction drawings and the user manuals of their central heating boilers.

Before self-assessment by home owners can be introduced, it is important to know how reliable it is. The test asked home owners to do a complete assessment of their houses. The resulting data were then compared with the assessment data recorded by a certified EPA advisor to evaluate the feasibility and reliability of self-assessments. In addition, a questionnaire asked the home owners whether they would be interested in contributing to assessments in exchange for a discount on the price of the energy performance assessment.

The energy performance assessment form developed for use by the home owners themselves was based on the existing EPA form, with questions clarified by means of explanations and illustrations. The form included questions on general characteristics (date of construction, number of residents and number of floors, orientation and natural gas consumption), construction details (surface areas and insulation) and questions about installations. The form was made available in

hardcopy and digital form. After the self-assessment form had been returned, the EPA advisor visited the houses for an EPA assessment. Table 5 shows the numbers of forms returned.

Table 5: Number of forms returned

Total number of forms returned	82
Fully completed forms	49
General data section completed	66
Construction section completed	67
Installations section completed	64

5.2.3 Quality of home owner assessments

Figure 4 compares the data reported by the self-assessing home owners with those reported by the certified EPA advisors. It shows the percentages of home owners whose data differed from or agreed with those of the advisors. As regards the surface areas of construction elements (floor space, glazing, outer walls, roof), a 'difference' was defined as a discrepancy of more than 10% between the two assessments. As regards the date of construction, a 'difference' was defined as a discrepancy of more than five years.

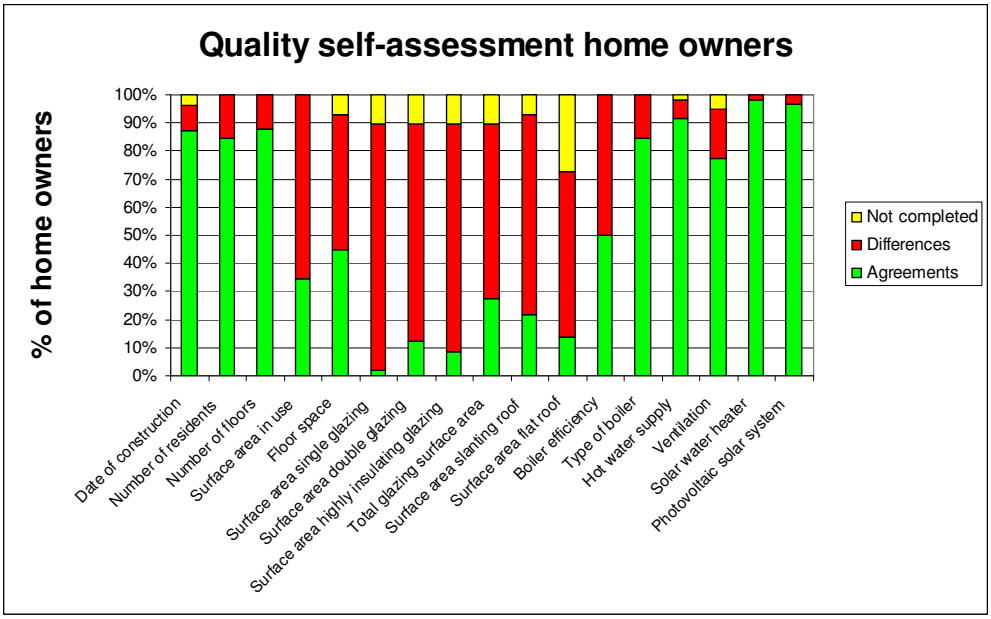


Figure 4: Quality self-assessment home owners

The analysis allows the following conclusions:

- General characteristics like date of construction, number of residents and number of floors showed good agreement between the two assessments.

- Over 80% of self-assessments agreed with those by the advisor as regards home installations (hot water supply, space heating), though there was slightly less agreement about ventilation systems.
- Home owners were well aware of the type of central heating boiler they used (in terms of conventional, improved efficiency or high-efficiency boilers), though they found it harder to indicate the precise efficiency of high-efficiency boilers (100%, 104% or 107%). This is indicated in the graph as 'boiler efficiency').
- Most of the assessments of surface areas differed by more than 10% from the reports by the EPA advisors.
- Differences were particularly great in estimates of glazing surfaces classified by different types of glazing, partly because it was difficult for home owners to ascertain the type of insulation glazing. There were, however, also large differences in estimates of total glazing area: more than 70% of the home owner assessments differed by more than 10% from the advisors' estimates.

It was not only the surface area estimates that differed, but there were also considerable discrepancies in the assessments of the level of insulation of parts of the building shell (see figure 5). We cannot conclude from the findings whether these discrepancies arose because home owners did not know whether – and where – their homes were insulated, or whether they misinterpreted the assessment form.

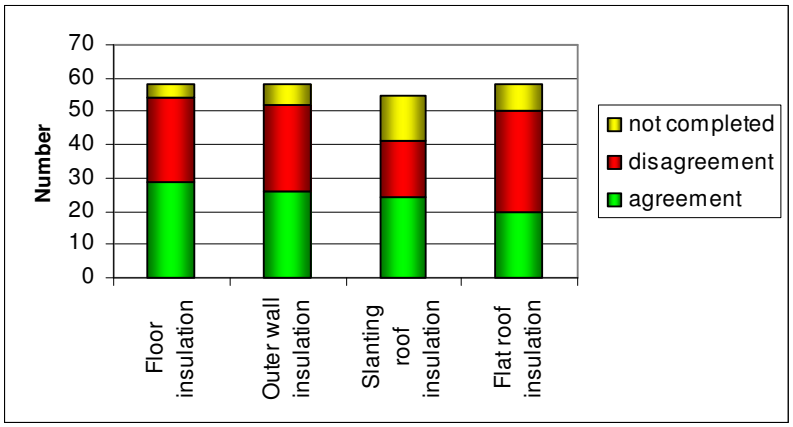


Figure 5: Overview discrepancies in the assessments of insulation

5.2.4 Conclusions on home owners assessments

What information can be reported by home owners?

Our comparison of assessment reports shows considerable discrepancies between self-assessments by home owners and those by EPA advisors as regards surface areas. In addition, home owners found it difficult to indicate whether and where insulation was used in their houses (floor or roof insulation, single or double glazing). They were usually unable to provide information on the

insulating properties or the type of insulation glazing. This means that these data cannot be used for energy performance assessments.
On the other hand, home owners were able to reliably report general characteristics such as type of house, construction date, number of residents and number of floors, as well as information on installations. They were also able to supply construction drawings (which can be used to determine surface areas), user manuals of central heating boilers (which can be used to determine efficiency) and tenders for insulation measures taken in the past. This may help reduce assessment times and costs.

Would home owners be interested in supplying information?
The home owners who participated in the test supplied information on general characteristics of their houses and aspects of construction and installations. Figure 6 shows how much time it took them to do so. The questionnaire that accompanied the draft EP certificate and the tailored advisory report asked them how much time they would be prepared to invest in self-assessment and reporting, in exchange for a 20% discount on the price of the energy performance assessment the results are also shown in the figure.

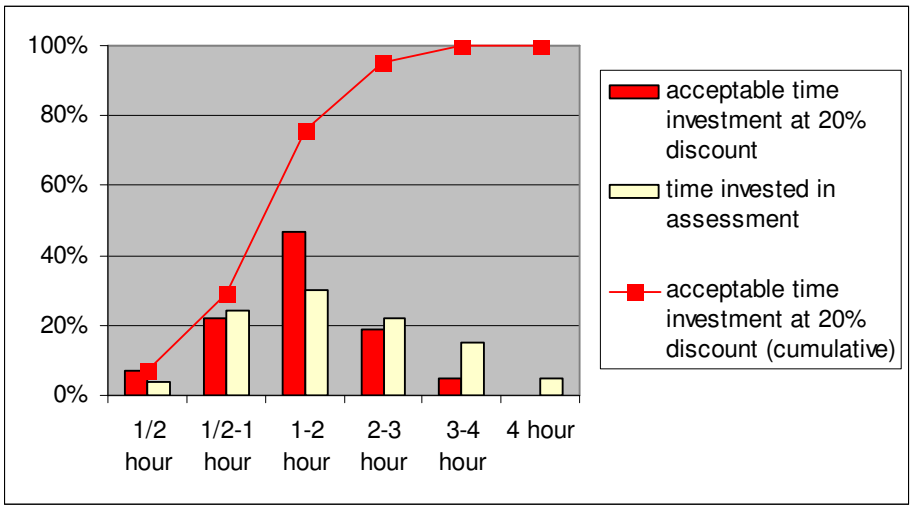


Figure 6: Overview time investment home owners

Figure 6 shows that almost 80% of the home owners would be prepared to invest up to two hours of their time in exchange for a 20% discount. About 60% of the home owners had not spent more than two hours on the assessment. The analysis thus shows that self-assessment by home owners can best be limited to general characteristics of the house and its installations. These data could well be supplied by home owners to EPA advisors on a simplified assessment form, together with construction drawings, user manuals of central heating boilers and tenders for insulation measures implemented in the past. Collecting these data would not need to take the home owners more than two hours.

How do EPA advisors feel about home owners' contributions?
When interviewed, the EPA advisors reported that it would save an hour of their time if home owners supplied general information on the house, as well as construction drawings and the user manual of their central heating boiler. As chapter 6 shows, one hour amounts to about 20% of the total time required for one EPA. Hence, a 20% time reduction would be a realistic estimate.

On-line home-owner assessments in practice
In The Netherlands in practice websites exist where homeowners get a direct on-line indicative insight on the energy label class for their home after providing a limited amount of input data characterising their home. The certified energy performance calculation engine behind these sites uses these input data, completed with a number a default values for the specific dwelling type and age, to asses the label class category. Furthermore homeowners can on-line asses the effect of improving their home with different types of energy saving measures and see the effect on the energy label class. If they are interested in acquiring a full certified energy performance advice (EPA), and in future the official energy performance certificate, they can order this online. The input data already supplied on-line are used for preparation of the building inspection and enable some time savings for the energy advisor.

5.2.5 Experts in the test

After the building assessment by the home owner, an official energy advisor performed an energy performance assessment. The energy performance assessments in the test were implemented by five certified (BRL9502) EPA advisors associated with the *EPA-centrum Nederland* (Dutch EPA centre).

5.2.6 Training of experts

On 9 June, 2006, at the start of the test, Ecofys offered a half day training course to EPA advisors, to inform them about the purpose of the test, to discuss the process and planning of the test, to instruct them on the procedure of composing the sets of recommended measures and to inform them about changes in the EPA software and reporting system. At the time of the training course, however, the new software was not yet available. A number of 'bugs' were later discovered, about which the advisors received additional instructions (telling them to apply certain corrections to the reports).

5.2.7 Building assessments by experts

The delay in the availability of the software led to some initial problems in training the advisors. In addition, there was some pressure of time, as some home owners had planned holidays. After the advisors had gained some experience and had received some additional instructions, the process ran more smoothly and results improved. The assessments for the houses associated with the *'Service-punt Warm Wonen'* energy saving campaign were carried out in June and July of 2006. The assessments were started before the new EPA software became available.

Time invested by EPA advisors

Based on feed-back from advisors on the time spent in 36 energy performance assessments, we determined the average amount of time invested in the various components of the EPA. The average overall time required was 4.8 (±0.7) hours.

The average time distribution in the EPA assessments is shown in figure 7.

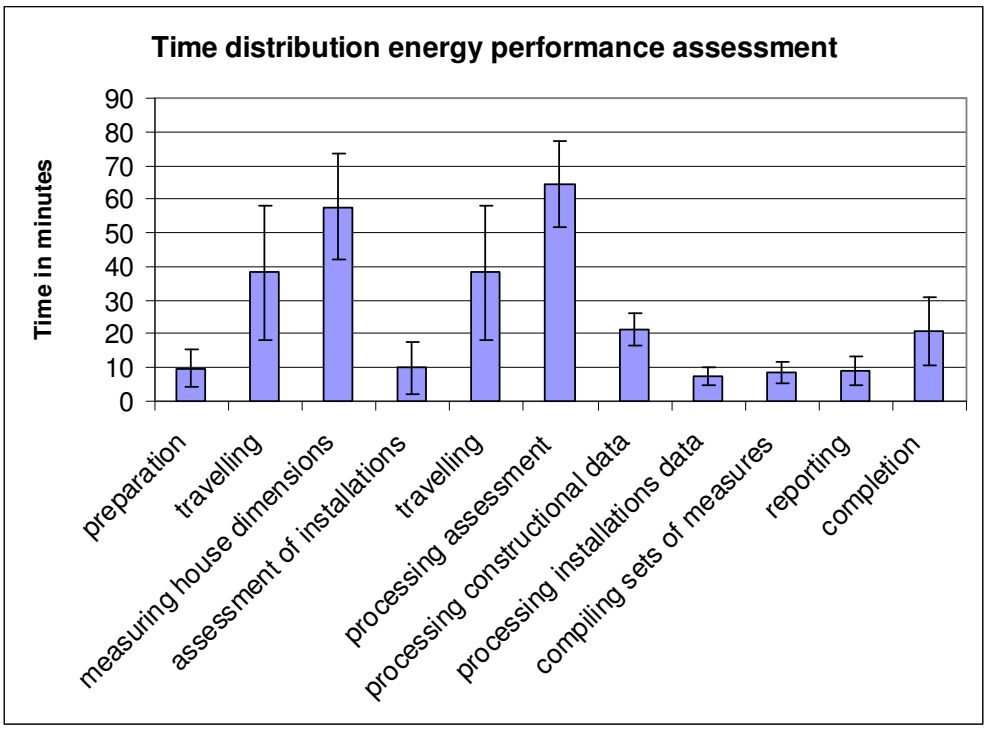


Figure 7: Time breakdown over the EPA components

It is striking that travelling and the processing of the recorded assessment data required a relatively large share of the total time investment, and that the advisors spent very little time (about 10 minutes) on reporting. This short time offers little opportunity to check the standardised report produced by the software and to add specific tailored explanatory comments. The advisors have offered to do the energy performance assessments at a fee of €100 each.

5.2.8 Analysis of the building inspection by experts

The analysis of the EPA reports and the feedback provided by the home owners in the questionnaire survey allows a number of conclusions to be drawn regarding the building inspection by experts:

1) The procedure by which the advisors composed the sets of recommended measures;
2) Errors made by the advisors;
3) Tailored adjustments made by the advisors;

Each of these main aspects is briefly discussed below. Other minor aspects are the subject of a separate report.

1) Composing the sets of measures

A new option in the EPA5 software is that it 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.

Nevertheless, the test showed that the recommended sets of measures varied considerably. In addition, the sets did not always seem consistent in terms of building physics. In some cases, it was recommended to replace single glazing only on one side of the house, or insulation of an outer wall which was characterised in the report as 'poorly insulated' was not included in the set of measures. Measures were not always prioritised in terms of payback time. The advisors reported that they had to get used to the new iterative process of composing sets of measures that meet certain requirements.

A number of problem points were identified that need to be addressed before introducing the new software:

- The recommended sets of measures must be consistent in terms of building physics (like preventing condensation on cold surfaces by balanced sets of measures), rather than merely meeting specific requirements. A set should not be regarded as 'finished' as soon as it meets the requirements for such sets. The advisors could be assisted better in the process of composing sets of measures by the software, help files and a manual with clear instructions.

- It should be investigated whether the current description of the quality of the existing insulation should be more detailed. A cavity wall retrofitted with insulation and qualified as 'poorly insulated' is correctly not included in the set of improvement measures. Since the description of the insulation quality does not allow such details to be included, however, the resulting set of measures appears inconsistent.

2) *Errors made by the advisors*
The test results show that various errors were made in compiling the EPA reports, including administrative errors (name of advisor missing, incorrect postal codes, etc.), incorrect assessments (installations being recorded which were not present or installations which were present not being recorded) and recommendations for measures which had already been implemented.

3) *Tailored adjustments made by the advisors*
The advisors taking part in the test made few tailored adjustments to the reports. This was also evident from the average time of 10 minutes spent on reporting.
The adjustments they could have made are related to:
- Specific comments to explain the choices made in composing the sets of recommended measures or optional comments on damp, cold bridges, ventilation, open appliances and lead piping.
- Comments on the quality of the existing insulation and the recommended insulation measures, with more detailed information on types of glazing or insulation, though avoiding too detailed technical information like U values.
- References to suitable moments for measures to be taken (such as when an old boiler needs to be replaced or when window frames need renovating).

Another aspect that should be considered is that parts of the building were not always labelled in a way that is recognisable to the home owner (e.g. glazing 1, outer wall 2). Clear instructions for this should be included in the software and the manual.

Advisors generally appeared to have let the software produce the reports automatically, not to have checked them thoroughly before delivery and to have added few tailored comments. These problems may have been partly caused by pressure of time (as summer holidays were approaching) and the modest fee the advisors received per EPA.

5.2.9 Lessons learned and recommendations

- 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 EPA advisors. On the other hand, owners were able to supply accurate information on characteristics like the type of house, date of construction, number of residents and number of floors and installations, and to provide construction drawings and user manuals for central heating boilers, as well as tenders for previously implemented insulation measures. This information can help reduce the advisors' assessment time and thus reduce costs.

- 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 well be supplied on a simplified assessment form, together with construction drawings, user manuals of central heating boilers and tenders for insulation measures implemented in the past. EPA advisors report that it would save an hour of their time if home owners supply these data and confirm the possibility of a 20% discount is this case.
- One problem with the new approach to composing sets of energy-saving measures in the EPA software tool is that it does not automatically improve consistency and comparability across advisors, nor necessarily produces sets of measures that are consistent in terms of building physics (like preventing condensation on cold surfaces by balanced sets of measures). We recommend that software and the handbook/manuals for advisors should offer clear instructions for the process of composing sets of measures.
- The advisors were found to spend little time on tailored adjustments to the reports generated by the software, such as adding specific comments to explain the selection of measures, or the optional report sections on damp, cold bridges, open appliances and lead piping. The average total time spent preparing the report, including a final check, was about 10 minutes.
- We recommend that EPA training courses should offer more information on these tailored adjustments and on the procedure of composing consistent and comparable sets of measures.

Recommendations to other countries:

- Training, software and handbooks should provide good support for the selection of sound packages of improvement measures. Sound in terms of building physics, economics (the right order of pay back time) and tailored well to the specific building.
- Quality control in the form of central validity checks and/or (random) on-site inspections can be important mechanisms to ensure the quality and credibility of the certification system. The information collected and analysed enables a feedback loop for periodic improvement of training, software and handbooks.

6 Calculation of energy performance

6.1 National overview calculation methodologies

6.1.1 Calculation methodology for new buildings

Currently a substantial part of the EPBD has already been integrated into Dutch law. Article 3, The methodology for new buildings already complies with the current Energy Performance Standard (EPN) introduced in 1995 as part of the national building code. All new buildings need to be built according to the EPN requirements in the Building Code.
The EPN energy Performance determination method is based on the national standards NEN 5128 and NEN 2916.
The EPC calculation method determines an energy performance coefficient (EPC) which represents the primary energy consumption of the building, independent of the building geometry. A maximum EPC value is enforced by the building codes. This value is lowered periodically, thus strengthening energy performance requirements.

6.1.2 Calculation methodology for existing dwellings

For the existing building stock the existing Energy Performance Advice (EPA-W) methodology, introduced in 2000, is being simplified. The required calculation procedure will be ready before the end of 2006 and will be described in a national standard BRL9501 and in the Handbook ISSO 82.

The EPA-W process was introduced in 2000 as a voluntary policy instrument aimed at stimulating home owners to take energy efficiency and renewable energy measures. Within the method the energetic quality of an existing dwelling or complex of dwellings is calculated. The resulting energy index is independent of user behaviour. The energy advice however does include user behaviour by taking into account the measured use of natural gas and the dwelling occupation. Advice is given for possible improvements (measures, financial effects, and payback times). Only EPA's executed by certified consultants were eligible for subsidies (subsidy for the EPA itself and for the proposed measures).
The calculation method determines the energy consumption for space-heating, domestic hot water and electricity for fans and pumps. Renewable energy sources are also taken into account, such as passive solar energy, solar collectors, photovoltaic panels, heat recovery, and heat pumps. Based on the primary energy consumption under standard indoor and outdoor conditions, an energy performance index is then calculated, known as the Energy Index (EI).

The EI is defined in such a way that it is independent of the housing geometry and the user behaviour. This means that the EI is only determined by the energy quality of the building. A large villa can therefore have the same EI as a small apartment, as long as their energy quality is the same (same level of insulation, same installations etc.). EPA-W has been introduced for individual homeowners as well as for social housing and commercial apartment building owners (multifamily housing).

6.1.3 Calculation methodology for flats

For multi-family buildings or large blocks of row dwellings there will be a possibility to base the calculation of an EP certificate on the data of an EP certificate of a reference dwelling. The calculation procedure will be described in the “Regulation on Energy Performance of Buildings” (REG) and in the national standards BRL 9501 and BRL 9500-01.

6.1.4 Calculation for non-residential buildings

For existing non-residential (and non-industrial) buildings a new, voluntary scheme has been developed in 2005, but it has not been issued. Now the scheme is converted in a mandatory EPBD scheme. The calculation procedure will be ready before the end of 2006 and will be described in a national standard BRL9501 and in the Handbook ISSO 75.

6.2 Calculation methodology used for Impact test

6.2.1 Approach

The EPA advisors implemented the Dutch IMPACT test using a trial version of the new EPA software (version 5.0, 29 June 2006), which was prepared for the test. SenterNovem commissioned CapGemini to develop this updated version of the EPA software. New features of this software include a new reporting template for the tailored advice, improved cost indicators and a new equation to calculate the energy index, designed to fit in with EP certification under the European energy performance directive (EPBD). The calculation method and software tool comply with BRL 9501 describing the quality of the calculation method according to ISSO-publication 54 'Energie Diagnose Referentie (EDR) - eengezinswoningen en kantoorgebouwen'.

Another change concerns the procedure of composing the sets of recommended measures. The software now asks the advisors to select two sets: one set offering an ‘optimal’ performance level (Energy Index (EI) <1.15; energy class label A or B) and one offering a ‘sufficient’ performance level (EI between 1.15 and 1.3; label C). Any deviations from the sets have to be motivated by the advisors. Further changes to the software include the removal of certain errors

and other improvements. 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.

Since it was known in advance that the trial version of the software provided for this test was not yet perfectly operational, the advisors were instructed to correct certain aspects of the report by hand.

6.2.2 Results of Evaluation

The analysis of the EPA reports and the feedback provided by the home owners in the questionnaire survey allows a number of conclusions to be drawn about the software and the calculation:

1) the standardised reporting template produced by the software;
2) potential miscalculations in the software;
3) Investment costs and payback times

Each of these main aspects is briefly discussed below. Other minor aspects are the subject of a separate report.

1) *The standardised reporting template produced by the software*
   The new software offers a considerably improved reporting template. The following problem points were identified in the test:
   - The quality classification of the existing insulation (in terms of poor, moderate or good) does not indicate whether existing outer walls are insulated or not and what type of glazing has been used. A cavity wall retrofitted with insulation is given the qualification 'poor' in the report, creating the impression that there is no insulation, unless a further comment is added. Although the advisors had the opportunity to add such comments, they did not actually do so in this test.
   - The report does not clearly define the qualifications 'sufficient' and 'optimal'.
   - Since the EPA advice will be regarded as supplementary to the EP certificate, it would be useful to include in the EPA report information on the current energy label of a house and the energy label that could be attained by implementing the recommended measures.

2) *Potential miscalculations in the software*
   A number of reports appeared to show miscalculations. These could be due to software errors[2], or to incorrect use of the software or errors in the processing of the report by the advisor.

[2] After completion of the test, an error was discovered in the equation used in the trial software to calculate the EI. The equation has now been corrected, the EI calculation method has been simplified and the classification system has been revised.

3) *Investment costs and payback times*

We have analysed investment costs and payback times for the two types of sets used in the test, i.e. the 'sufficient' set of measures (set I, leading to class C) and the 'optimal' set (set II, leading to class A or B).

The average cost of implementing set I ('sufficient') was less than € 5,000, while the average cost of implementing set II ('optimal') was about € 7,500-10,000 more. Investment costs were of course higher for houses whose energy performance (EI index) before measures was poorer.

The average payback time for set I ('sufficient') was 20 years (±12) and that of set II ('optimal') 25 years (±18). The payback time was clearly longer for houses whose energy performance before measures was better (i.e. which had a lower EI). The average payback times, even those for the 'sufficient' set, were fairly long.

It could be considered to select the measures in the 'sufficient' set on the basis of payback time (e.g. a maximum of 10 years). Another option would be to always base calculations on the additional investments rather than pure investment costs. For example, when replacing a conventional boiler (at the end of its life-time) by a high-efficiency one, one could use only the additional investment costs, as the boiler needed to be replaced anyway. This approach to investment costs would need to be explained in the report.

6.2.3 Lessons learned and recommendations

- The results of the test have led to a number of (separately reported) recommendations to improve the EPA software and report template.
- As discussed in paragraph 5.2.8 a problem with the new approach to composing sets of energy-saving measures is that it does not automatically improve consistency across advisors, nor necessarily produces sound and comparable sets of measures. We recommend that the software and the manual for advisors should offer clear instructions for the process of composing sets of measures.
- It is suggested to set a maximum pay back time criterion for one set of the advised measures (eg. a maximum of 10 years) to increase the follow-up potential of the advice (people actually improving their homes).

Recommendations to other countries :

- The calculation software should provide good support for the selection of sound packages of improvement measures. Sound in terms of building physics, economics (the right order of pay back time) and tailored well to the specific building.

- Set a maximum pay back time criterion for one set of the advised measures (eg. a maximum of 10 years) to increase the follow-up potential of the advice (people actually improving their homes).

7 Energy performance certificate

7.1 National overview energy certificates

The Dutch government has decided to introduce a simple and concise mandatory EP 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 tailored advice goes further than the planned EP certificate, which only shows current energy performance and offers a standardised list of cost-effective improvement measures.
The certificate will have a label scale A-G, according to CEN. The energy certificate format will have the same format for all types of buildings.

7.2 Energy certificate used for Impact test

7.2.1 Approach

The Dutch government has decided to introduce a simple and concise mandatory EP 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 tailored advice goes further than the planned EP certificate, which only shows current energy performance and offers a standardised list of cost-effective improvement measures.
For approximately 100 households, EP certificates and EPA reports have been produced by a group of certified energy advisors. The residents received both documents in one package, together with 2 questionnaires, one to assess their appreciation of the EP certificate and one for the EPA report. Home owners were asked to process both documents and questionnaires independently and in the correct order, i.e., first that regarding EP certificate and then that regarding the EPA report. After a substantial percentage of the questionnaires had been returned, they were processed to analyse the feedback provided by the home owners.

7.2.2 Design of the energy performance certificate

A trial energy performance certificate has been designed (see figure 8 and appendix 1).

The design was based on the following principles:

- Since the EP certificates generated in this test have a 'special status'[3], the trial certificate and the information provided to participants state that this trial certificate cannot be used as an official certificate in the future implementation of the European directive on energy performance.
- The certificate had to be simple, meeting the minimum requirements of the European energy performance directive (EPBD).
- Measures to improve energy performance had to be selected on the basis of feasibility and cost-effectiveness for average Dutch housing conditions. A simple decision tree was designed to select the measures. The selection procedure does not take account of problems stemming from the construction or installations in individual houses. As a result, the certificate may propose a different selection of measures than the EPA report.
  The classification system used in the certificates is based on the energy index, calculated with the new version of the EPA software.

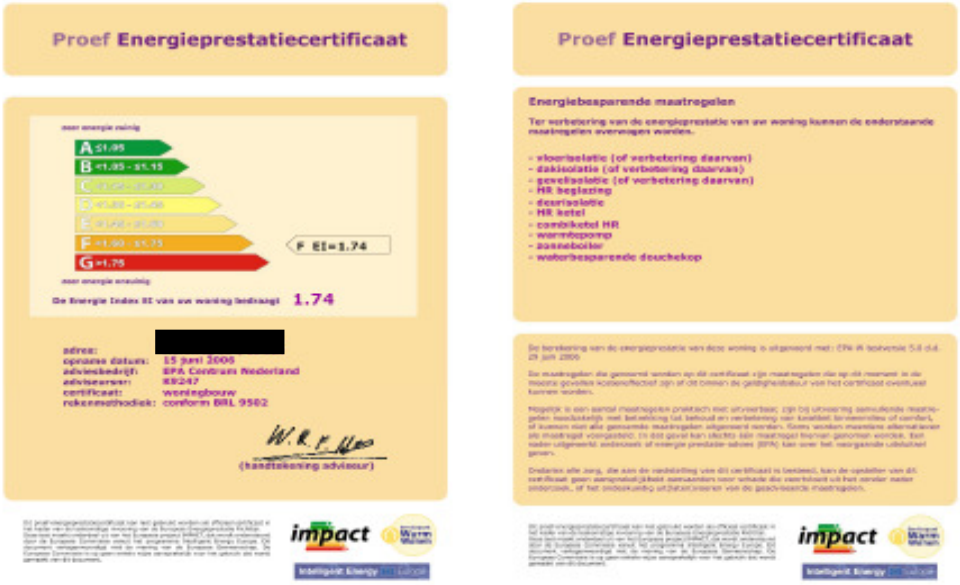


Figure 8: The energy performance certificate

[3] After the test had been completed, the equation used to calculate the Energy Index was adjusted, a new classification was designed and the EI assessment method was simplified, to allow cheaper certificates by reducing administrative costs.

7.2.3 Analysis of energy certificate production

The energy performance certificates were produced by Ecofys on the basis of a selection of the measures selected by the EPA advisors for individual houses. Although all EPA advisors had received the decision tree for this purpose, there were some initial errors in the process of selecting measures for the certificates, as insufficient distinction was made between the set of measures recommended in the EPA and the measures selected for the certificate. The instructions were repeatedly discussed with the advisors, and the lists of measures for the certificate were revised. An analysis of the measures selected for the certificates after these corrections showed that the selection process then functioned properly (figure 9).

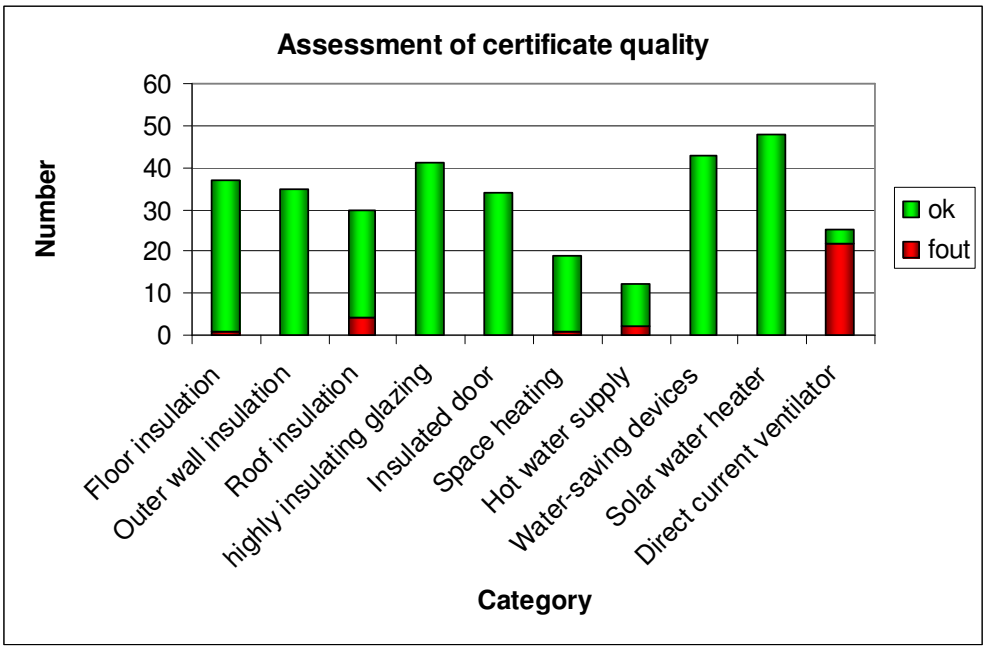


Figure 9: Overview assessment of certificate quality

The analysis shows that the one element that the advisors frequently failed to include in the certificate was the direct current ventilator. This is probably because this appliance was the only one listed on the very last page of the decision tree, and was therefore overlooked.

It can be concluded that, with appropriate instructions, the decision tree can help the advisors select the right measures for the certificate. On the other hand, this process could easily be automated, using the assessment data, which should lead to lower costs (since taking less time) and to higher quality (fewer errors).

The process does lead to differences between the sets of measures indicated on the certificates and those recommended in the EPA report. Since some home owners indicated in the questionnaire that they were confused by this, it is important to explain to them why these differences may occur. Such differences may occur in the following cases:

- If the construction characteristics of a house preclude the use of floor insulation, this type of insulation will be included in the certificate but not in the EPA report.
- If a cavity wall has been retrofitted with insulation, but its U value is too low, outer wall insulation will be included in the certificate but usually not in the EPA report.
- If a house is fitted out with a geyser type water heater, the certificate will recommend a heat pump boiler, without it being checked whether the required mechanical ventilation is available, whereas EPA advisors may take this into account in their reports.
- As a result of personal preferences of the advisor or at the request of the home owner to include or leave out specific measures in the tailored report.

7.2.4 End user appreciation of certificate and advice report

- Sixty-nine percent of the respondents regarded the certificate as useful or thought it provided added value.
- Further analysis showed that 88% of the home owners who said they intended to implement the recommended measures regarded the certificate as useful, against 45% of those who did not intend to implement the measures.
- Seventy-nine percent said that the tailored report provided added value over and above that of the certificate.

Appreciation of the certificate and the tailored EPA report

Figure 10 illustrates the home owners' appreciation of various aspects.

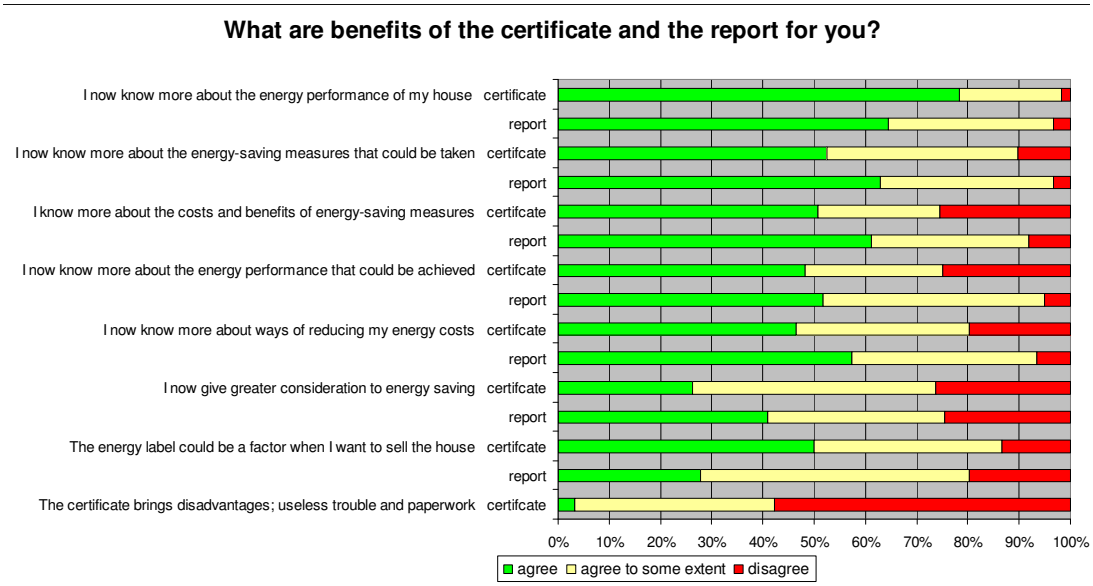


Figure 10: Overview of the benefits and the report

Interesting aspects of this figure include the following:

- Many respondents said that the certificate had helped them understand the costs and benefits of energy-saving measures, the energy performance that could be achieved and the reduction in energy expenditures. This is surprising, as this information was not actually provided in the certificate. This finding, together with the way in which respondents completed the questionnaires showed that they had trouble distinguishing between their appreciation of the certificate and that for the tailored EPA report. The respondents seem to have given a combined appreciation of the certificate and the additional EPA report. Presumably, if people had been asked to evaluate the certificate and the tailored advisory report completely separately, there would have been greater differences in appreciation between the two.
- The personal comments added by the respondents to the questionnaire forms clearly show that they thought that the EPA report provided additional value over and above that provided by the certificate, since it shows the costs and benefits, as well as referring to the specific situation of their own house, providing explanatory comments, specifying the recommended measures, etc. The certificate says nothing about the actual energy consumption or about the costs and benefits and specific feasibility of the recommended measures.
- Based only on the number of times the 'Agree' answering category was ticked for the statements 'I now know more about the energy performance of my house' and 'the energy label could be a factor when I want to sell the house', respondents attached significantly greater value to the certificate than to the tailored report in this respect. If the 'Agree to some extent' answering category is also included in the calculation, the difference becomes considerably smaller.

- The tailored report was more highly appreciated in terms of the other aspects.
- If the 'Agree' and 'Agree to some extent' answering categories are combined, the following aspects of the certificate end up at or just below the 80% limit: 'I now know more about the costs and benefits of energy-saving measures', 'I now give greater consideration to energy saving and 'I now know more about ways of reducing my energy costs'.
- Most respondents did not agree with the statement 'The certificate only brings disadvantages; it's just a lot of useless trouble and paperwork'.

Responses to the statement 'I now have a more accurate idea of the quality of my house' show that this aspect was more adequately provided by the certificate than by the report, as was evident from the finding that 90% indicated that the certificate allowed them to judge the energy performance of their house at a glance, whereas only 73% said this was the case with the EPA report.

Eighty-six percent of the respondents thought that the EP certificate could be a factor when selling the house (based on the 'Agree' and 'Agree to some extent' answering categories). On the other hand, 60% indicated that the certificate would play no role or only a minor role if they were to buy a new house themselves.

Forty-four percent indicated that energy efficiency would play a minor role for them when buying a new house, while 11% would not be prepared to pay extra for an energy-efficient house with lower monthly overheads.

7.2.5 Cost aspects

Figure 11 shows the maximum price home owners would be willing to pay for the certificate and how much they would be willing to pay for a tailored report in addition to the certificate. It shows, for example, that 39% of the respondents answered that they would want to pay less than € 50 for a certificate, and 40% of these answered that they would not be prepared to pay anything extra for a tailored report on their house.

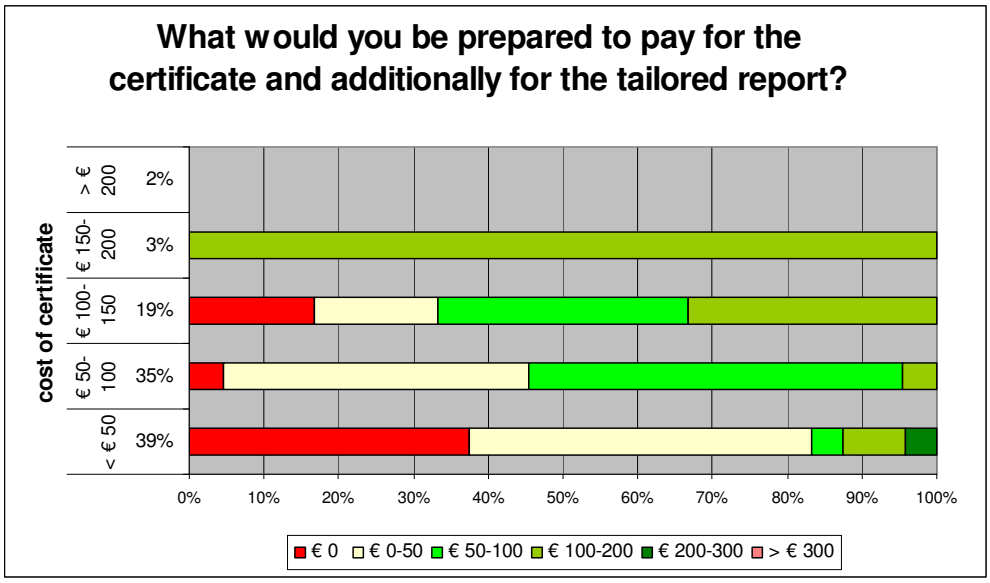


Figure 11: Summary of willingness to pay for certificate and report

The figure shows some striking results:

- Most of the respondents (74%) would be prepared to pay a maximum of between 0 and 100 euros for the certificate, with the median situated in the € 50-100 category.
- Respondents who were prepared to pay more for the certificate were also prepared to pay more additional money for a tailored report; this probably relates to personal views.
- There was no significant group of respondents who were unwilling to pay much for the certificate but would be willing to pay a lot extra for a tailored report, nor the other way round.

7.2.6 Lessons learned and recommendations

- Most home owners regarded the EP certificate as useful (69%) and as potentially being a factor when the house is to be sold (82%), although the importance of the certificate in this respect was generally regarded as subordinate to that of other characteristics of the house (60%).
- The certificate clearly helped the respondents understand and become aware of the energy performance of their houses (>95%).
- The introduction of energy performance certification is expected to have its effects not only on the implementation of energy-saving measures; it will probably also affect the value of a house at the time when it is sold or rented out to a new tenant, and so provide an indirect stimulus for energy-efficient housing. This effect could be further increased by linking the certificate to mortgages (in terms of the ratio between mortgage levels and incomes), systems of property valuation and tax instruments.

- Energy performance advice (EPA) as a non-compulsory instrument was regarded by 79% of the respondents as providing added value to the EP certificate and as providing information that is needed to actually invest in energy-saving measures (i.e. information on specific measures, savings and cost–benefit ratios).
- The EPA report was regarded as a supplement to the certificate. Therefore we would recommend that the EPA report should also include information on the current energy label of a house and the label that could be achieved by implementing energy-saving measures.
- The majority of the respondents (74%) were prepared to pay a maximum of € 50–100 for a certificate. About 25% of them would not be prepared to pay extra for a supplementary EPA report, while 50% would be prepared to pay up to € 50 for such a report and 25% would pay up to € 100 extra. This means that the financial basis of thorough tailored advice is limited. It should be noted here that the average age of the respondents was relatively high. This fact, and the relatively long payback times for the measures, could explain the relatively poor financial basis found in this test.
- The financial basis of energy performance certification and advice could be increased by getting home owners to contribute to the assessment. Having them supply the advisor with general information on the house, as well as construction drawings and the user manual for their central heating boiler, could reduce the costs of an energy performance assessment by about 20%. The home owners were prepared to invest up to two hours of their own time to supply these data in exchange for a 20% discount.
- It seems unlikely that the voluntary advice will have a high penetration unless it is linked to other policy measures, like e.g. linking the improvement of the energy label to investment subsidies, the white certificate system and/or tax incentives.

Recommendations to other countries :

- Distinguishing a simple and concise mandatory certificate (label and standardised list of measures) from a supplementary tailored advice (including investment cost and pay-back times) as a decision document could help in addressing the different addressees (seller and buyer of a home) with the appropriate information.
- If the financial basis for a tailored voluntary advice procedure is low (people not willing to spend money for a proper advice) it should stimulated with effective incentive measures.

8 Presentation of certificate to end-user

8.1 Planned national approach

In the planned national approach a personal elucidation of the certificate or the advice is not required. The certificate will normally be sent by mail to the home owner. The only possibility for a personal oral advice to home owner is during the building assessment. As the government leaves a lot to the market actors, additional tailored advice services may be developed by market actors.

8.2 Approach in Impact test

8.2.1 Approach

For approximately 100 households, EP certificates and EPA reports have been produced by a group of certified energy advisors. The residents received both documents by mail in one package, together with 2 questionnaires, one to assess their appreciation of the EP certificate and one for the EPA report.
During the building inspection advisors can give a tailored advice to home owners or respond to questions home owners may have. Advisors deal with this very differently, some take time for a personal elucidation, others don't. In the questionnaires the home owners have been asked to evaluate the assessment by the EPA advisor.

8.2.2 Lessons learned and recommendations

Aspects of energy assessment that were considered important
The home owners regarded nearly all aspects of energy performance assessment as important or very important. Aspects that were considered particularly important were affordable assessment fees, an indication of investment costs and payback times, an indication of energy costs and energy-saving opportunities and recommendations for measures (see figure 12).

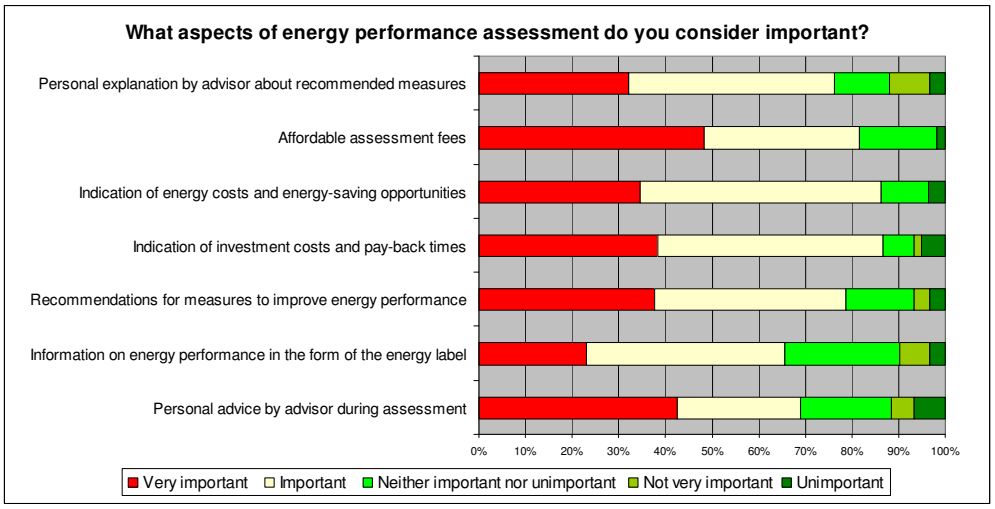


Figure 12: Importance of EPA aspects.

Personal advice and explanations by the EPA advisor were regarded as important by most of the home owners.

Evaluation of house assessment by the EPA advisor

The home owners were also asked to evaluate the house assessment by the EPA advisor. The results are depicted in figure 13 below, which shows that the respondents would prefer more or better explanations of the recommended measures. In some cases, respondents even reported that the recommendations in the report differed from those given orally by the advisors during the assessments, or that measures recommended by the report were discouraged by the advisors during the assessments. A number of home owners said that the advisor did not appear to have a clear vision during the home visit, or failed to explain the choice of measures based on a sound assessment of building physics and potential risks (e.g. possible risk of moisture problems when insulating cavity walls).

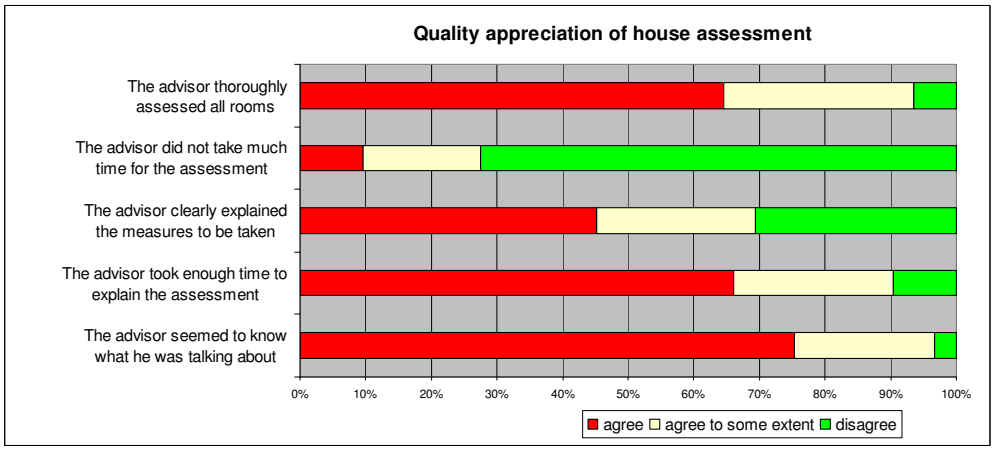


Figure 13: Evaluation EPA advisor.

Recommendations to other countries:

- As personal advice on improvements is regarded as important by home-owners it is recommended to develop (or stimulate the development) of follow-up services that guide home-owners to experts that can give a tailored and personal advice on home improvements.

9 Impact on implementation of measures

- On the basis of the certificate, 27% of the home owners announced their intention to implement energy-saving measures in the coming year.
- Three of these respondents (18%) had not had any intentions to implement such measures before receiving the certificate.
- The main arguments for implementing energy-saving measures were:
  - reducing energy costs;
  - improving personal comfort levels;
  - reducing environmental damage;
  - improving the energy performance of the house.

  The relative importance they attached to the various arguments is illustrated in figure 14.

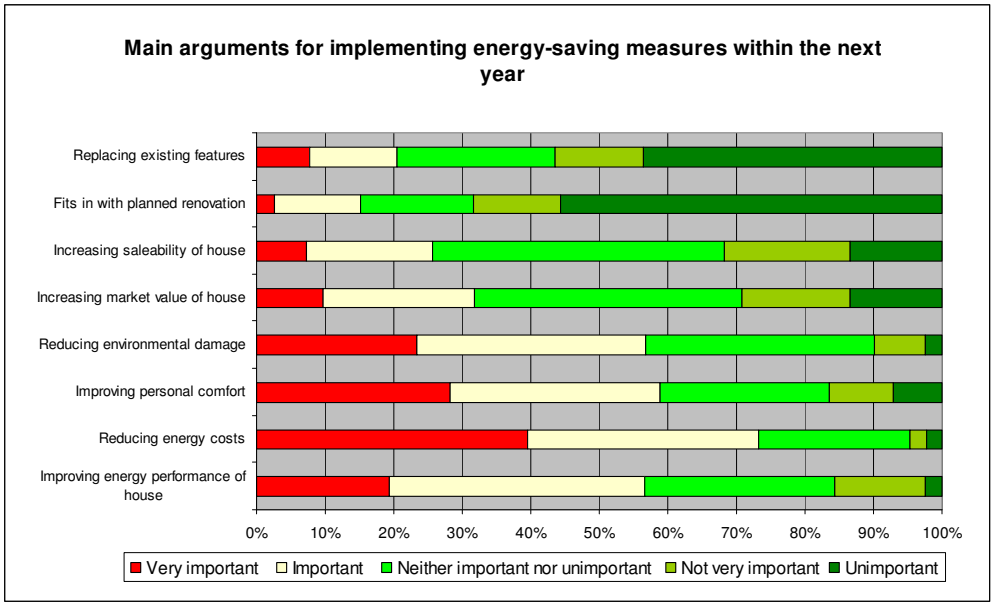


Figure 14: Summary of arguments for implementing energy saving measures within the next year

- The introduction of energy performance certification is expected to have its effects not only on the implementation of energy-saving measures; it will probably also affect the value of the house at the time when it is sold or rented out to a new tenant (since 82% of the respondents thought that the EP certificate might be a factor in selling their house). This means that the certificate could also provide an indirect stimulus for energy-efficient housing. This effect could be further increased by linking the certificate to mortgages (in terms of the ratio between mortgage levels and incomes), systems of property valuation and tax instruments.

- Thirty-nine percent of the respondents were not yet sure whether they would implement measures, and 32% did not intend to do so; figure 15 illustrates the arguments given for the intentions not to implement measures and the number of times each argument was mentioned.

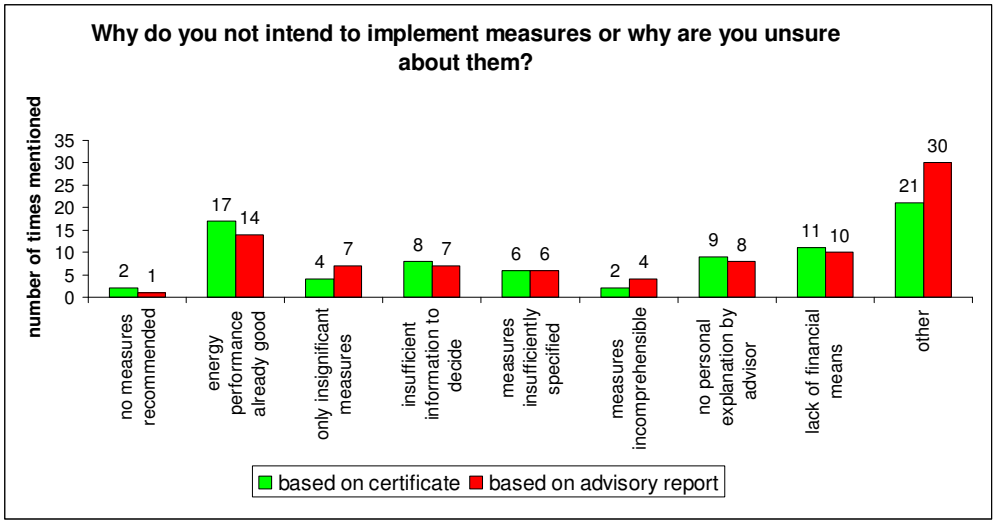


Figure 15: Arguments on not implementing the energy saving measures

  - The argument that 'the energy performance of my house is good' was nearly always corroborated by the facts.
  - The 'other' category included particularly the argument of long payback times, whether or not in combination with the respondents' advanced age.
  - The arguments that only insignificant measures were recommended and that the respondents could not understand the recommended measures were used more often with respect to the report than to the certificate. A summation of the numbers for categories 3, 4, 5 and 6, all of which relate to the quality of the recommended measures (insignificant, insufficient information, insufficiently specified, incomprehensible) yields sums of 20 and 24 for the certificate and report, respectively, which is rather high (on a total of 44).

- The percentages of respondents stating that they will or will not implement energy-saving measures or are not yet sure did not differ much between the report and the certificate, though there were minor differences:
  - Twelve percent of the respondents who expressed the intention to implement measures on the basis of the certificate were unsure about it on the basis of the report.
  - Five percent of the respondents who did not intend to implement measures on the basis of the certificate did intend to do so on the basis of the report.

- Four percent of the respondents who were unsure about implementing measures on the basis of the certificate did intend to do so on the basis of the report.
- Four percent of the respondents who were unsure about implementing measures on the basis of the certificate did not intend to do so on the basis of the report.

- Eighty-five percent of the respondents had had energy-saving measures implemented previously; the distribution of measures is illustrated in figure 16.

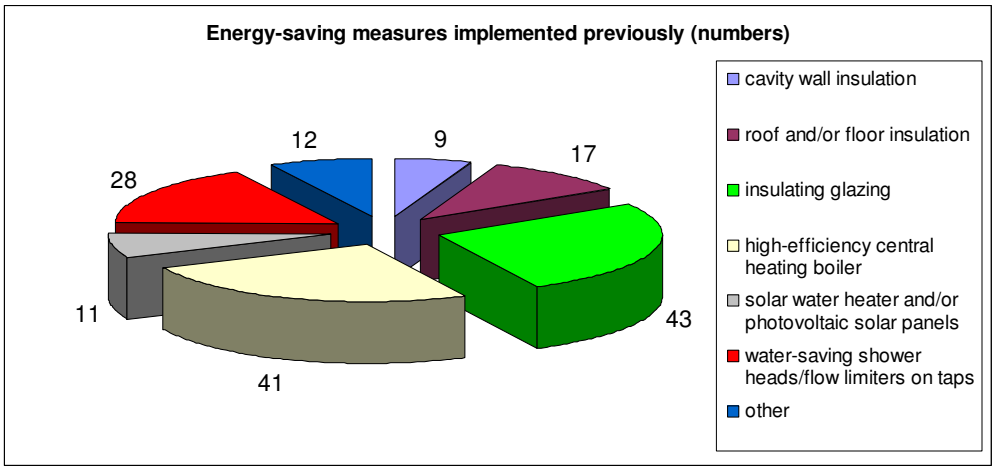


Figure 16: Energy saving measures implemented previously

9.1.1 Conclusions

- Twenty-seven percent of the respondents intended to implemented energy-saving measures on the basis of the certificate, whereas 18% of these respondents (i.e. 3 home owners) had not intended to do so before receiving the certificate.
- The energy performance advice (EPA) as a non-compulsory instrument was regarded by 79% of the respondents as providing added value to the EP certificate and as providing information that is needed to actually invest in energy-saving measures (7.2.6). Hence one can conclude that the extended tailored energy performance advice is a prerequisite for the actual stimulation of energy savings in dwellings.
- As it was found that the financial basis for the voluntary energy advice is fairly low (chapter 7.2.5) it seems unlikely that the advice will have a high penetration unless it is linked to other policy measures, like (investment) subsidies, white certificates and/or tax incentives.

10 Conclusions and Recommendations

10.1 Conclusions and recommendations for national EPBD implementation

The objective of the European directive on the energy performance of buildings (EPBD) is to achieve energy efficiency. The Dutch government has decided to introduce a simple and concise EP certificate, supplemented by a more comprehensive optional tailored advisory report.

In the context of the Dutch IMPACT test, 94 trial energy performance certificates and advisory reports were produced, and 62 questionnaires for home owners were validly completed and returned. The findings must be evaluated in light of the fact that the respondents did not constitute a fully representative sample of the Dutch houses and home owners.

The following conclusions can be drawn from the test:

- The certificate clearly helped the respondents understand and become aware of the energy performance of their houses (>95%). Twenty-seven percent of the respondents intended to implemented energy-saving measures on the basis of the certificate, whereas 18% of these respondents (i.e. 3 home owners) had not intended to do so before receiving the certificate.
- Most home owners regarded the EP certificate as useful (69%) and as potentially being a factor when the house is to be sold (82%), although the importance of the certificate in this respect was generally regarded as subordinate to that of other characteristics of the house (60%).
- The introduction of energy performance certification is expected to have its effects not only on the implementation of energy-saving measures; it will probably also affect the value of a house at the time when it is sold or rented out to a new tenant, and so provide an indirect stimulus for energy-efficient housing. This effect could be further increased by linking the certificate to mortgages (in terms of the ratio between mortgage levels and incomes), systems of property valuation and tax instruments.
- Energy performance advice (EPA) as a non-compulsory instrument was regarded by 79% of the respondents as providing added value to the EP certificate and as providing information that is needed to actually invest in energy-saving measures (i.e. information on specific measures, savings and cost–benefit ratios).

- The EPA report was regarded as a supplement to the certificate. Therefore we would recommend that the EPA report should also include information on the current energy label of a house and the label that could be achieved by implementing energy-saving measures.
- The majority of the respondents (74%) were prepared to pay a maximum of € 50-100 for a certificate. About 25% of them would not be prepared to pay extra for a supplementary EPA report, while 50% would be prepared to pay up to € 50 for such a report and 25% would pay up to € 100 extra. This means that the financial basis of thorough tailored advice is limited. It should be noted here that the average age of the respondents was relatively high. This fact, and the relatively long payback times for the measures, could explain the relatively poor financial basis found in this test.
- The financial basis of energy performance certification and advice could be increased by getting home owners to contribute to the assessment. Having them supply the advisor with general information on the house, as well as construction drawings and the user manual for their central heating boiler, could reduce the costs of an energy performance assessment by about 20%. The home owners were prepared to invest up to two hours of their own time to supply these data in exchange for a 20% discount.
- It is recommended to link the voluntary energy performance advice to specific incentive measures in order to stimulate it's penetration.
- 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 EPA advisors. On the other hand, owners were able to supply accurate information on characteristics like the type of house, date of construction, number of residents and number of floors and installations, and to provide construction drawings and user manuals for central heating boilers, as well as tenders for previously implemented insulation measures. This information can help reduce the advisors' assessment time and thus reduce costs.
- The above conclusions justify the statement that the Dutch government's decision to use a simplified EP certificate and non-compulsory tailored EPA advice side by side does work in practice and is appreciated by home owners.

Ensuring the quality of energy performance advice and certification

- The results of the test have led to a number of recommendations to improve the EPA software and reports.
- A point for improvement regarding the new approach to composing sets of energy-saving measures is that it does not automatically improve consistency and comparability across advisors, nor necessarily produces sound and cost-effective sets of measures. We recommend that the software and the manual for advisors should offer clear instructions for the process of composing sets of measures.

- The advisors were found to spend little time on tailored adjustments to the reports generated by the software, such as adding specific comments to explain the selection of measures, or the optional report sections on damp, cold bridges, open appliances and lead piping. The average total time spent preparing the report, including a final check, was about 10 minutes.
- We recommend that EPA training courses should offer more information on these tailored adjustments and on the procedure of composing sets of measures that are consistent in terms of construction and installations.
- There were certain differences between the measures recommended by the certificates and the energy performance advice. An example would be a cavity wall which has been retrofitted with insulation but has an insufficient U value; this would be included in the certificate as outer wall insulation, but usually not in the EPA report. It is important to explain this clearly to home owners.
- The use of house assessment data to select improvement measures for inclusion in the certificate with the help of the decision tree could easily be automated, which should reduce costs (less time investment) and potentially increase quality (less errors).

10.2 Recommendations for other countries

- Training, software and handbooks should provide good support for the selection of sound packages of improvement measures. Sound in terms of building physics, economics (the right order of pay back time) and tailored well to the specific building.
- Quality control in the form of central validity checks and/or (random) on-site inspections can be important mechanisms to ensure the quality and credibility of the certification system. The information collected and analysed enables a feedback loop for periodic improvement of training, software and handbooks.
- Set a maximum pay back time criterion for composing sets of advised improvement measures (e.g. a maximum of 10 years) to increase the follow-up potential of the advice (people actually improving their homes).
- Distinguishing a simple and concise mandatory certificate (label and standardised list of measures) from a supplementary tailored advice (including investment cost and pay-back times) as a decision document could help in addressing the different interests of addressees (seller and buyer of a home) with the appropriate information.
- If the financial basis for a tailored voluntary advice procedure is low (people not willing to spend money for a proper advice) it should stimulated with effective incentive measures.
- As personal advice on improvements is regarded as important by home-owners it is recommended to develop (or stimulate the development) of follow-up services that guide home-owners to experts that can give a tailored and personal advice on home improvements.

Annex A: Draft certificate used in test

See next page

Proef Energieprestatiecertificaat

De Energie Index EI van uw woning bedraagt 1.55

adres:	[redacted]
opname datum:	**6/19/2006**
adviesbedrijf:	**EPA Centrum Nederland**
adviseursnr:	**12**
certificaat:	**woningbouw**
rekenmethodiek:	**conform BRL 9502**

W. R. F. Hes

(handtekening adviseur)

This trial energy performance certificate cannot be used as an official certificate in the context of the future introduction of the EU directive on energy performance. This test is part of the European IMPACT project, which is supported by the European Commission's Intelligent Energy Europe programme. This document does not represent the opinion of the European Community. The European Commission is in no way responsible for any use that may be made of this document.

Dit proef-energieprestatiecertificaat kan niet gebruikt worden als officieel certificaat in het kader van de toekomstige invoering van de Europese Energieprestatie Richtlijn. Deze test maakt onderdeel uit van het Europese project IMPACT, dat wordt ondersteund door de Europese Commissie vanuit het programma Intelligent Energy Europe. Dit document vertegenwoordigd niet de mening van de Europese Gemeenschap. De Europese Commissie is op geen enkele wijze aansprakelijk voor het gebruik dat wordt gemaakt van dit document.

impact

Servicepunt Warm Wonen

Intelligent Energy Europe

Proef Energieprestatiecertificaat

Energiebesparende maatregelen

Ter verbetering van de energieprestatie van uw woning kunnen de onderstaande maatregelen overwogen worden.

- **dakisolatie (of verbetering daarvan)**
- **gevelisolatie (of verbetering daarvan)**
- **HR beglazing**
- **zonneboiler**

The energy performance of this house was calculated using a trial version of the EPA-W 5.0 software package (29 June 2006). The above energy-saving measures are those which are currently cost-effective in most situations or might become so within the term of validity of this certificate.

Some of the above measures may be impracticable, or may require additional measures to maintain or improve the quality of the indoor air or personal comfort. It may not be possible to implement all measures. Several alternative measures may be proposed, in which case only one of them can be implemented. Further information on these aspects can be provided by a supplementary assessment or energy performance advice (EPA).

Although we have taken the utmost care in drawing up this certificate, we cannot accept any liability for damage resulting if the recommended measures are implemented without further prior assessment or in an incompetent way.

This trial energy performance certificate cannot be used as an official certificate in the context of the future introduction of the EU Directive on energy performance. This test is part of the European IMPACT project, which is supported by the European Commission's Intelligent Energy Europe programme. This document does not represent the opinion of the European Community. The European Commission is in no way responsible for any use that may be made of this document.

De berekening van de energieprestatie van deze woning is uitgevoerd met: EPA-W testversie 5.0 d.d. 29 juni 2006

De maatregelen die genoemd worden op dit certificaat zijn maatregelen die op dit moment in de meeste gevallen kosteneffectief zijn of dit binnen de geldigheidsduur van het certificaat eventueel kunnen worden.

Mogelijk is een aantal maatregelen praktisch niet uitvoerbaar, zijn bij uitvoering aanvullende maatregelen noodzakelijk met betrekking tot behoud en verbetering van kwaliteit binnenmilieu of comfort, of kunnen niet alle genoemde maatregelen uitgevoerd worden. Soms worden meerdere alternatieven als maatregel voorgesteld. In dat geval kan slechts één maatregel hiervan genomen worden. Een nader uitgewerkt onderzoek of energie prestatie-advies (EPA) kan over het voorgaande uitsluitsel geven.

Ondanks alle zorg, die aan de vaststelling van dit certificaat is besteed, kan de opsteller van dit certificaat geen aansprakelijkheid aanvaarden voor schade die voortvloeit uit het zonder nader onderzoek, of het ondeskundig uit(laten)voeren van de geadviseerde maatregelen.

Annex B: References

[BP 2006] Country review Netherlands buildings platform PO07, 28/08/06

[COW 2004] Cijferts over wonen 2004, VROM.

[KWR 2000] Basisrapportage Kwalitatieve Woningregistratie 2000, VROM