Challenge to apply European standards to existing buildings
ENPER EXIST Project

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ABSTRACT

ENPER -EXIST is a project in the framework of the 'Intelligent Energy – Europe' Programme (IEE) of the European Commission. The main goal of ENPER-EXIST is to de-fragment technical and non technical work performed on existing building to support the take off the Energy Performance of Buildings Directive (EPBD, Directive 2002/91/EC). Then, based on strategic vision and on a better knowledge of existing buildings specificities, it helps to prepare the future actions for a possible revision of the EPBD. The project team consists of seven EU Member States and, is co-ordinated by CSTB –France. The project started in January 2005 and will last for thirty months

This paper gives an overview of the objectives and the work program of the project. A description of the first results of the project follows on the analysis of some standards prepared by the CEN with respect to their relevance and applicability to existing buildings. Analyses are based on the experience of participating MS on the calculation of Energy Performance for existing buildings.

KEYWORDS

Energy Performance, Existing building

PROJECT BACKROUND

The decision to launch ENPER EXIST project was made during the final workshop of ENPER TEBUC project in Budapest in 2003 – see www.enper.org. This workshop involved representatives of different targets groups: Energy in building policy makers, technical and non technical advisors of policy makers, teams applying policies, participants to the CEN group, European manufacturers associations, agencies in charge of information dissemination on energy in building. It raised the importance of having an action specifically dedicated to existing buildings to allow a smoother implementation of the requirements of the directive since member states are facing more difficulties in this area.

A strong coordination with interest groups organised in the preparation phase of the project allowed the definition of the objectives:

1. To de-fragment technical work performed on existing buildings. On one hand actions already launched in CEN to apply the EPBD are de-fragmented but mainly focus on new buildings. On the other hand different projects on certification procedures are going on at the European level but are not coordinated.

2. To de-fragment work on legal, economical and organisational problems such as the analysis of certification on the market, the human capital and the national administrations.
3. To achieve to a better knowledge of the European building stock.
4. To define a roadmap for future actions regarding existing buildings

One of the major challenges of ENPER Exist project is to identify the link with relevant projects in order to:

- enable de-fragment work and knowledge concerning existing buildings
- Foster collaboration among projects for optimal re-to use of the progress and the results from works realised in the other projects.

A starting point to achieve this objective is the first workshop of ENPER EXIST where presentations of the identified relevant projects will be made

PROJECT ADDRESSED ISSUES

Existing buildings – technical issues: tools application

In the previous years standardization and regulations concerning the reduction of energy use has in most European countries been focused particularly on new buildings. Looking at the CEN standards which are developed in the past years, you see this same tendency.

The draft CEN standards, which have been developed last year to apply the EPBD, again heavily focus on new buildings and forget to take into account the effects which are especially important for existing buildings.
One goal of ENPER- EXIST is to identify the gaps between the EPBD CEN standards and practice for existing buildings.

The analysis will result in numerous gaps and various points of attention. Experiences of Member States with calculation methods of the energy performance of existing buildings in their countries will be used to test, evaluate and if necessary extend or improve the CEN standards.

Preliminary results of this task are described further below in this article.

Existing buildings – impact of certification procedures on no technical issues

For an effective implementation of the procedures of certification or thermal regulation for existing buildings, it is necessary that Member States take into account the financial, human and administrative aspects on top of the technical aspects. These issues are must be tackled in the development of the procedure so that they do not constitute an obstacle to reach the objectives aimed by the EPBD.

Within ENPER EXIST project the non technical aspects that will be studied deal with the impact of certification procedures on the market (economic aspect), on the human capital and on the administration

For the economic impact, it is important to identify the direct and indirect cost of the certification processes and its impact on labour in order to study the possible economic schemes that must be developed for financing the application of certification schemes

For the human capital, it is important to study and to analyse the suitable procedures to better integrate the certification experts to the building's market. It is necessary to estimate the required number of certifiers with the adequate educational and training effort

For the national administration, it is important to identify the necessary new structure to be created and the transformations that should happen to the national administrations

Existing Buildings – which information available and which possible potential of energy savings?

When setting up requirements on energy performance for existing buildings, it is of prime importance to define the criteria which are most influential on the performance of the building. This fact implies a careful selection of data with respect to the type of building.

ENPER EXIST focuses on the evaluation of the level of knowledge in the member states on the existing buildings stock from energy performance point of view: thermal characteristics of different components of the envelope and efficiency of the heating, ventilation and air conditioning systems

The way of using this knowledge (data) is as important as its availability. ENPER EXIST will attempt to analyse the way the available data is effectively used by policy makers. The goal is to compare the different approaches of member states and to take into account their experience in order to give recommendation on the type of information needed for an efficient use by policy makers when setting up energy saving measures and the way of improving the level of its knowledge.

ENPER EXIST will study how to improve knowledge of the existing building stock using certification schemes. It will allow a better knowledge of the possible potential of energy savings in European existing building stock and the categories of buildings with a highest potentials of energy saving.

Existing buildings – preparation of future actions

The goal of a roadmap for future actions is to clearly structure the type of measures adapted for existing buildings, to give indications of alternative strategies for a wide scale improvement of the energy efficiency of existing buildings and to identify possibilities for widening the scope of the EPBD in case of a future revision of the requirements of EPBD.

To achieve this objective, it is important to set up a close interaction with the members of EPBD concerted action and with the EPBD platform in order to make maximum use of existing information and to define a roadmap that will take into account the vision of a maximum number of actors.

CHALLENGE TO APPLY EUROPEAN STANDARDS TO EXISTING BUILDINGS: PRELIMINARY RESULTS OF THE FIRST ANALYSES

A first step in the analysis of available information and ways to determine potential energy savings as stated in the above is to analyse the application of European Standard for the calculation of energy performance of existing buildings. In parallel a survey via a questionnaire is performed among the member states participating within the project on the way the Energy Certificate is being implemented in their respective country so that the criteria for analysis of the standards can be refined in due course.

Basic aspects regarding energy performance calculations for existing buildings

To give a good incentive for effective energy saving measures, the following issues should be dealt with regarding the calculation methods and procedures:

- **Soundness (accuracy)** - results must be credible
- **Applicability –** it must be applicable to all types and sizes of building and also in adequation with the level of expertise of the users
- **Repeatability –** the user interface of the calculation method should be set in such a way that different people should obtain the same answer (what input data?)

These issues can be completed with the expected cost of an evaluation of the energy performance of a building which clearly will influence the level of expertise of each evaluation. To give an indication of the costs which are foreseen, some Member States plan for a certificate (residential buildings) to cost €300 to €500 (Denmark, Germany), some others plan to go more in the direction of €100 to €150 (Greece, the Netherlands).

Regarding the accuracy, CEN methods do not aim at predicting the exact energy use of a particular building since any "theoretical method" is based on assumptions (weather data, occupancy pattern and behaviour…) that deviate from actual use. The methods aim at providing information whether it is necessary for an owner to improve the energy performance of a building and indicate what improvements are most effective.

Because of the use of software tools, it is not the complexity of the calculation method itself which influences the costs of an energy assessment of a building. The problem lies with the input parameters. The amount of input parameters which has to be gathered can constitute a problem either on availability or level of expertise of the user.

The first action on analysis of CEN standards is focused on the usability of the input parameters in the CEN methods as well as on missing influencing factors which are especially important for existing buildings. The following standards were analysed:

- The draft CEN standard on space heating generation with combustion systems (work-item 9, CEN/TC 228 WI 023 (2005)),
- The draft CEN standard on lighting energy estimation (work-item 13, prEN 15193-1 (2005)),
- The draft CEN standard on the energy use for space heating and cooling (work-item 14, prEN ISO DIS 13790 (2005)).

General preliminary results

Default tables

In general a lot of problems with input parameters for existing buildings can be solved by providing tables with data based on simple characteristics, like age and/or typology. For instance in the standard on the energy use for space heating and cooling the solar heat gain is influenced by the solar energy transmittance of the windows (g-value). For new buildings the window properties are known; this parameter can be found in the documentation from the manufacturer of the window. For existing buildings we can only rely on default values of typical window types. The standard should supply these default values. In some situations it can be advisable to supply default values on national level. For all the analysed standards, the parameters which need default lists for easy use regarding existing buildings are identified.

Measured data

Some standards describe methods to measure certain input parameters. Where measurements are easily available, these can be used. But performing measurements is not a realistic task within the limited budget of the certificate. There should always be an alternative procedure to estimate the parameters or an alternative method with a different (preferably less detailed) approach.

For instance the standard on space heating generation with combustion systems contains three methods to calculate the generator seasonal efficiency. Even the simple typology method uses measurement results, which is not realistic for existing boilers. In our opinion, simple tables with seasonal efficiencies should be preferred. A good option is to use the typology method described in the standard to derive key figures. Such tables could be easily used and will be very well adapted to existing buildings. It is desirable to have a common procedure to derive the tables. It could also be desirable even to derive common tables for all Member States.

In the UK such a table (database) based on a typology method, is developed for residential buildings (see www.sedbuk.com). This method uses results from standard laboratory tests together with other characteristic factors such as boiler type, ignition arrangement, internal store size, fuel used, knowledge of the UK climate and typical domestic usage patterns. However for existing boilers which are off the market, no test results are available. The Sedbuk-method does not cope with these boilers yet. It is foreseen that for existing boilers default efficiency values will be defined based on age and type of boiler plant. A similar table is used in the Dutch voluntary energy performance advice tool for existing buildings, based on typology mainly. In the French energy regulation in year 2000, a database of boilers was established by the association of manufacturers. This database enables an easy description of boilers but in this case also it applies to new and very recent boilers.

The disadvantage of using key figures is that they will make the chance of deviation from the actual boiler efficiency bigger. But on the other hand obtaining the necessary input is simple, which results in relative accurate data acquisition with few efforts. Furthermore it is the question whether it is necessary to make a very accurate estimation of the efficiency of old boilers: when assessing the benefit of installing a new boiler, the size of the improvement is much greater than the differences between the efficiencies of different existing boilers.

Simplified methods

Sometimes using default tables is not enough to make a method usable for existing buildings. For those aspects simplified calculation methods need to be derived. A good example is thermal bridges. Taking into account thermal bridges can be a time consuming task. The effect of a thermal bridge depends on the type of thermal bridge and on the insulation value of the construction surrounding the thermal bridge. For poor insulated buildings, the effect of heat bridges is very small. In moderately insulated buildings the effect of poor designed connections can be as huge as small thermal bridges in good insulated buildings. So ignoring thermal bridges in existing buildings is no solution. Taking into account all thermal bridges is not efficient either. There should be a method which gives a good balance between the insulation value of the building and the type of heat bridge which may be ignored and which have to be taken into account, preferably using as much default values and as few input parameters as possible. A solution could be to take the impact of the thermal bridge into account as a variation of the U-value of the construction, depending on the level of insulation.

Missing influencing factors

A good example of a missing influencing factor which can be of great importance in existing buildings is aging. For instance aging of glazing is a very slow process and is not taken into account in the determination of the U-value of glazing. The effect can be large, so this is a point of concern for existing buildings. In comparison: Aging of insulation material is a relative quick process and is already taken into account in the determination of the calculation values of the lambda of insulation material.

Findings of questionnaire energy performance certificate scheme

To produce a vision of what different countries are doing concerning the certificate, we circulated the questionnaire on the energy performance scheme provided in the standards on ‘Methods for expressing energy performance and for energy certification of buildings’, prEN 15217 (2005). The following Member States have filled in the questionnaire: France, Denmark, Sweden, Greece, Germany, Belgium (Flanders), Ireland, United Kingdom (England and Wales), the Netherlands. The answers of the different countries are based on expectations on how the certificates will be developed or on running schemes which cover all or only part of the directive concerning this subject.

We conclude the following from the results: Many countries plan to introduce the ‘washing machine label’ (the coloured A-G arrows, suggested in prEN 15217 (2005). Some will change/expand the number of categories (Dk). Others plan to use a continuous scale (De, Be (for new buildings)). Sweden plans to use no categories at all.

Most schemes are based on an asset rating. Denmark uses operational rating for large buildings. Sweden plans to use operational rating to assess multi family houses and Belgium (Flanders) to assess public buildings.

In most countries the scheme is under development, only in Denmark the scheme is under application. In some countries pilot studies are running (Fr, De). In other countries the calculation method runs in another form and on voluntarily basis (NL).

NEXT STEPS

Work of analysis of the Standards is going to continue, other relevant standards will be analysed. The final report is expected for March 2006

Work on non technical issues is on going. A questionnaire was prepared by the work package leader to collect synthetic information on national approaches. The first analysis of the questionnaire answers are on going. The intention is to prepare a more detailed questionnaire on the impact of the certification procedures and regulations of existing buildings on the market, on the human capital and on the national administration on the basis of the results of this first questionnaire. The final report is expected for March 2006

These non technical issues are high interest for the CA. Collaboration has been agreed with the task leaders of the CA

The other subjects of this project are starting up (building stock knowledge) or will start later.

References

Poel, A. (2004). Efficient assessment of the Energy Performance of buildings. Balancing the inaccuracies of the assessment stages. Report of EU ALTENER EPA-ED project. EBM-Consult BV, Arnhem (NL), September 2004 (http://www.epa-ed.org)

prEN 15217, 2005. Energy Performance of Buildings - Methods for expressing energy performance and for energy certification of buildings, CEN, Brussels, March 2005

CEN/TC 228 WI 023, 2005. Heating Systems in Buildings — Method for calculation of system energy requirements and system efficiencies — Part 2.2.1: Space heating generation systems, combustion systems, CEN, Brussels, July 2005

prEN 15193-1, 2005. Energy Performance of Buildings – Energy requirements for lighting – Part 1: Lighting energy estimation, CEN, Brussels, March 2005

prEN ISO DIS 13790, 2005. Thermal Performance of Buildings – Calculation of energy use for space heating and cooling. ISO, Geneva, May 2005