[European projects]

P181

20.12.2009

Barriers and good practice examples identified during early implementation of the EPBD

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During the transposition and early stages of implementation of the EPB Directive into national practices, several issues appeared either as barriers, or as points for discussion. This paper, which is part of a study in the framework of the ASIEPI project funded by the Community's Intelligent Energy Europe programme, aims to analyse the most common, or most critical of these discussion points for the implementation of the EPBD, in order to provide possible solutions and good practice examples for other countries.

1 > Introduction

Although the EPBD allows for quite some freedom in national requirements and even though the national boundary conditions (legal frameworks, cultural differences, climate etc.) may differ a lot from country to country, in practice it is proving that most countries have experienced, or are still experiencing similar challenges in implementation.

This paper summarises a selection of some of the most common or most critical discussions and barriers for implementation of the EPBD and the solutions taken to resolve those in individual MS. The study is restricted to a specific set of such barriers or discussion points, since the actual list of issues in question may in fact have been quite long. The investigated issues concern:

- How countries are handling certification in the case of apartment buildings
- Whether control systems are taken into account in the standard calculation methods
- Whether energy saving measures that are under discussion in specific countries in terms of e.g. questioned efficiencies, or health and safety reasons, exist
- Whether energy efficiency technologies, such as mechanical ventilation with heat recovery, are common even against indoor quality
- Whether the results of a national method in one country are accepted in another country
- How the gap between theory and practice is being bridged
- How conflicting interests from national regulations are being dealt with
- Whether summer comfort is being promoted to the detriment of energy efficiency

The analysis is based on internal discussions and the unofficial answers provided by the partners involved in the ASIEPI project on a simple internal questionnaire. The study is carried out during the summer of 2009 among

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Intelligent Energy Europe

13 countries (Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, The Netherlands, Norway, Poland, Spain and Greece). The information provided is mostly based on personal experiences of the partners involved in the project and therefore does not necessarily reflect the official position.

2 > Certification in case of apartment buildings

One of the issues that all MS had to resolve prior to implementation of the EPBD was the handling of certification for apartment buildings. The Directive leaves space for different approaches to this type of certification. Two are the most obvious options: a) to certify the building as a whole, or b) to certify each individual flat separately.

Clearly there are pros and cons for both options. Certification of the building as a whole is more economic and of course more evident where a central heating system without separate metering exists. However certification per apartment gives a better overview of the actual consumption and thus of the potential for energy savings.

In practice different combinations of the two options seem possible and effective. MS have dealt with the issue of certification of apartment buidlings in various ways. Four of the examined countries always assess the building as a whole, while 2 countries always assess just the individual apartments. In the remaining 5 countries, both options are possible under specific circumstances, either in parallel, or separately, e.g.:

- There is one certificate for the whole building, but one or more additional pages are used to describe the individual apartment;
- The whole building certificate may be obligatory, but the owner has the possibility to issue additionally a certificate for the individual apartment;
- Either the building as a whole, or the individual apartments can be certified;
- When the systems are collective, certification is per building, while in case of individual systems, certification is valid only per individual apartment.

Clearly, the specifications of apartment buildings are different in different countries and also different types of ownerships can have a substantial impact on the choice of the right approach. In general there is no one good approach which fits all needs [1].

Generally seen, with the exception of the 2 counries that always assess the individual apartments, when there is a collective installation system in the apartments building, the assessment will mostly be on building basis. Then the individual apartment's energy performance may either be considered the same for all individual apartments (same certificate for all the individual apartments), or be calculated based on the total real, or calculated, consumption in proportion to rental charges repartition rates of the apartment. Both ways, the apartments' energy certificate cannot represent the actual performance of the apartment. Upon certain conditions, the issue of a separate (additional)certificate for the individual apartment is possible, so that the actual situation is described. This not only better represents the actual potential for energy savings, it also helps understand user behaviour and trigger the owners awareness. Of course this usually goes together with a slight increase in costs for energy certification.

More information on the different approaches of certifications of apartment buildings can be found in [6,7].

3 > Control systems

All questionned countries do, to some lesser or greater extent, take into consideration in their standard calculation method control types. The mentioned types, in order of popularity are:

- Lighting (day- or artificial);
- Heating (thermostatic valves, pumps, night set back, week-end interruption, manual control);
- Ventilation (occupancy based, CO2, hybrid);
- Cooling;
- Humidity.

The way such controls are taken into consideration is mostly by default coefficients and (control and/or utilisation) efficiency of the system.

In one country the national EP calculation method normally prescribes a fixed value for the lighting load but a 20% lower value in case of advanced lighting control. In the same country, the efficiency of the energy delivery system is accounted for, but only in the energy label (which is based on *delivered energy*), not in permit applications for new buildings (based on *net energy demand*). This means that builders are more likely to invest in a well-insulted thermal envelope instead of efficient and delivery systems and control types (which have a shorter service life than the building).

In some countries, the Principle of Equivalence can be used to evaluate the performances of such control systems [2]. This basically means that a study is conducted to document the performance (e.g. efficiency) of a product, and this performance data can be used in energy performance calculations of buildings using that product (see also §6, below).

Finally, some control systems that are manually steered, are not always taken into account, as the human behavior is considered too difficult to predict.

4 > Questioned technologies

Various, especially innovative, systems are under discussion because the methods used to prove their energy efficiency are still questioned. It is difficult in practice to evaluate the complex assumptions and physics used in the various calculation methodologies, which are often ambigious.

One example is the discussion about how to calculate preheating from ground heat pumps. Another discussion is the calculation of the efficiency of the air-to-air heat pumps in relation to the actual outside air-temperature. In the case of high efficiency heat recovery from ventilation, the question is whether efficiencies reached under test conditions will also occur in practice, as true efficiencies are in certain cases found to be up to 10% less than manufacturer documentation.

Countries deal with such matters through the development of standardised calculation and occupants' behaviour methodologies. It means that average values of efficiencies of the appliances are entered into the calculation.

In addition to efficiency issues, other measures are questionned in terms of health and safety reasons. Balanced ventilation is under discussion in some countries because of presumed health risks (but not in the Nordic countries, which have long experience with mechanical ventilation). The main problem here is that people often keep the ventilation rate low, even when a high rate is needed for health reasons, due to ignorance, or noise problems with the fan. HVAC installations should be applied in a way assuring achievements of assumed environment quality in the

compartment along with rational use of energy for heating, cooling and electrical supply.

Similar issues seem to appear in almost all countries.

5 > Energy efficiency in relation to indoor climate

As a result of the EPBD requirements for the improvement of the energy performance of buildings, some new concepts and technologies have been introduced that are sometimes questionned in terms of indoor air quality. A clear example of this is building air-tightness. Mechanical ventilation with heat recovery is becoming more widespread, and is already well established in the coldest climates. It is assumed that also here some countries could question the influence of this technology on the indoor environment.

Indeed, mechanical ventilation (both supply and exhaust) with heat recovery is quite common in new or renovated, non residential and large buildings and in particular for low energy buildings. But even in cases where it is not yet common (like residential buildings), mechanical ventilation and heat recovery are steadily gaining a lot of ground.

The reason behind this is improved energy performance, especially in terms of heating, and in terms of compliance with the regulations. In most situations, regulations demand a minimum exhaust air heat recovery efficiency of the ventilation system. Cost efficiency is supporting the implementation of the technology in question, although a number of countries are arguing the benefits on indoor quality.

It is interesting to mention that 3 of the questionned countries, all of which have warmer climates, claim that mechanical ventilation and heat recovery is not yet quite common. In these cases, mechanical ventilation is required only if natural ventilation is not sufficient enough, and heat recovery is mandatory mainly when the required air volume is greater than a given value.Also the concept of airtightness has only recently been introduced.

6 > Determining system/product efficiency

When determining the energy performance (e.g. efficiency) of a new energy-saving technology or system, countries normally follow their own specific legal framework, certified methodologies and laboratories. The question is whether it is evident for one country to accept the results of such a study performed according to another EU country’s legal principles.

In the majority of countries, only CE/EN certified systems and technologies and test methods are accepted, so if the CEN method is followed for determination of the technical performance, then no additional measurements will be needed. At least two of the questionned countries accept the data of any certified European quality control institute or laboratory. However, in certain cases it is important to follow the local procedures, as the assumptions made often reflect very specific local conditions.

7 > Theory versus practice

It is well known that there can be a big gap between the functioning of a system on paper and in practice, or between the energy performance of a building as a whole or a building component, in theory and in practice. There can be many reasons for this: things can go wrong during the design, the installation, the fine-tuning and/or use of the system, and calculations are performed under ideal, standardised design conditions, etc.

The experiences with this issue between the 13 questionned countries do not vary much; all 13 countries seem to be aware of such discrepancies among asset and operational rating. The question is, how to deal with this fact in order to reduce the gaps in performance.

The study shows that in fact 8 out of the 12 countries who answered this question in detail do not have specific rules to adjust those discrepancies to. The ideal situation, which in rare cases is required also by building law, is to perform commissioning after the installation of a new system, or after construction. It is also advisable to do this when the building use is changed, or even after some years of use. Continuous commissioning by long-term monitoring and evaluation is the best option and is expected to be applied more and more often.

However, in most countries, it is the responsibility of the inspectors to identify if systems are not working properly, or efficiently and to report such discrepancies and propose saving measures in the EPC report. Similarly, the principal system designer or building designer is responsible to the building supervision authorities for carrying out his duties in an appropriate manner during the building project's design and construction phase. For this reason, both the building and system designer, as well as the inspector, should be highly qualified and sometimes even need specialist expertise.

Real life examples show that installers are not always sufficiently trained to install these complex systems correctly and/or adjust the systems correctly to the building use or building as a whole. As Europe wide EP requirements are becoming more and more severe, systems are expected to become more and more complex.

An additional problem is that various companies/installers are responsible for various parts of the system, but no one is responsible for the total system. In fact there will often be situations where the systems are so complicated that malfunction is noticed only in the commissioning phase, and failure has to be corrected afterwards.

It is of common expectation that the normal quality assurance of the construction works should take into consideration consistence with the overall design. In one country, specific certification procedures for individual craftmenships exist for specialised consultancy firms. Another country is introducing programs to evaluate specific buildings performances, the experiences of which are used to prepare the future regulation. Yet another approach is adoption of advanced monitoring and BEMS systems to control energy consumption.

Recently, initiatives that try to solve these problems by trying to formulate criteria for guaranteeing the performance of the total system/building in practice are under development.

A small number of countries aim to reduce the problem by introducing actual energy consumption against design consumption.

8 > Conflicting interests

During the initiative implementation of the EPBD, some countries faced the problem of conflicting national regulations that prohibit specific energy efficiency measures from being uptaken. One example is biomass burners, which are not allowed by law in some regions or countries, although in terms of energy efficiency they are considered better. Another example is the fact that retrofitting external insulation may conflict with the building regulations related to minimum distance to the land border.

Other examples of conflicting regulations in relation to the national EPBD law may also exist.

This study has shown that there are indeed countries that face such problems. Only 5 out of the 13 questionned countries seem not to have such conflicts. In the remainder, some kind of conflict may or does exist. The examples mentioned earlier are the two most typical examples of such conflicting interests among national laws.

The conflict of laws in the case of additional external insultion seems to appear in at least 5 of the questionned countries. However, in some situations the issue is solved either through relaxation of the building codes for external insulation in the case of renovations, or through the building authorities. In some cases, urban rules have been, or are being revised to favor energy performance, providing for example the possibility to increase the ratio of land built subjected to energy performance requirements.

An interesting approach is that, where an exception to the minimum distance to land border is possible, if the building adopts external insulated layer and presents a U-value lower than 10% than what is foreseen by national requirements; a bonus (an average of 10%) in terms of authorised volume for buildings with high energy performance.

A similar example is that of the simplification of the installation procedure of a solar system (PV or heating collector) so that such systems can be installed with less bureaucracy.

Another type of conflict mentioned is that of certain units (e.g. ventilation), systems (burners, heating) or materials (wood on facades), which may conflict with the national fire safety regulations in buildings, or other formal documents. Often, in such cases of conflicting interest, the environmental rights prevail only for security or safety reasons.

In one of these cases, banning some of the conflicting rules that would systematically prevent the use of such systems or materials, may occur. Also, the national law may take into account many aspects of the buildings regulations in exception to the regional or municipality regulations.

Finally, as proven in all countries, Historical Monuments protected by Law are excluded from the minimal energy requirements set by national EPBD law, so that in such buildings, renovation and works on envelope cannot respect the EP regulation, while RES may not be installed at all. The same exception is mentioned in one country where the EP requirements are contradictory with intrinsic qualities of the building (old buildings with particular hygrothermic transport in walls).

9 > Summer comfort and energy efficiency

Guaranteeing summer comfort and cooling in buildings is a growing challenge for most European countries. Nevertheless, calculation methodologies for assessing summer comfort and requirements for cooling are not yet advanced. The current EPBD regulations may in some cases give the impression that summer cooling is required, although there are plenty of other techniques to prevent overheating, without using energy for cooling. There are a few examples of countries whose EPB requirements are relaxed if cooling is applied, therefore allowing extra space for cooling energy use [3]. In this study we investigated whether this indeed is an issue in EU countries and how it has been dealt with until the time of the survey.

Scandinavian countries were not thought to have an overheating problem until recently, when tightening of the thermal isulation requirements increased the risk of summertime overheating.

In a few Northern and Central European countries, cooling is becoming an issue (mostly in larger administrative buildings with high occupancy, because of greater density of internal heat gains) and minimum energy requirements are not yet tight enough to promote less energy need or passive cooling design.

In the other countries cooling is an issue on a broader scale, covering both residential and non-residential buildings. Many countries choose and make obligatory the alternative cooling techniques and good building design above the use of mechanical cooling and air-conditioning systems to avoid overheating, however, detailed restrictions in regulation, relevant for example to system efificiencies during peak and part loads, limitation of cooling loads for different climatic zones and other, are not always in place.

Fortunately there are good exemptions to this, where for example limiting g-values, or maximum solar gain factors are introduced, or where for buildings with low internal gains, no allowance is given for mechanical cooling in the kWh/m^2a limit, therefore being possible to fullfill the requirements only through the buildings performance and high efficiency of service systems.

An interesting approach is that of penalising air conditioning use through the calculation method, which allows for same space for consumption, whether there is an air-conditioning system or not. At the same time this methodology is taking into account certain alternative cooling techniques, like e.g. night ventilation, and introduces minimum summer comfort requirements through solar window factors.

A similar approach is the prescription of the use of a very low room temperature set-point, if mechanical cooling is to be installed. This is intended to dissuade the use of mechanical cooling by giving it a high energy penalty. However, experience has shown that this rule has limited effect as it does not apply to central cooling in the air handling unit. As a result, the regulation has been tightned further with limits on glazing g-factor to ensure both good building design. Additionally one could set limits on the temperature set-point for central cooling systems as well.

Again a different approach was to expand the EP calculation to include the calculation of energy use for summer comfort. With this approach, passive cooling measures have an effect on the EP level of the house, even though no cooling system is present, because a fictive cooling system with specific efficiency is assumed. The idea behind this approach is the reasonable thought that, when overheating is a problem, occupants will buy such a system. Reducing the cooling need of the house will reduce the energy use of this portable system once it is bought, or (even better) limit the need of buying such a system.

In Southern European countries summer comfort is a major issue of concern and it is already very difficult to find buildings without air conditioning. Because in many such cases mechanical cooling can be avoided, careful desing and the use of alternative or passive cooling techniques should prevail above the use of cooling. It is therefore quite important to ensure that alternative cooling techniques are somehow integrated into the calculation methods and cooling loads are limited by law. Alternatively, if no cooling system exists, the minimum requirements can refer to an overheating indicator, the limit value of which is to demonstrate that no cooling will be necessary.

ASIEPI partners:
BBRI (BE; technical co-ordinator), NKUA (GR; financial & administrative co-ordinator), TNO (NL), IBP (DE), SINTEF (NO), CSTB (FR), Cete de Lyon (FR), REHVA (BE), ENEA (IT), AICIA (ES), NAPE (PL), VTT (FI), E-U-Z (DE), Enviros (CZ), SBi (DK)

Associated partners:
Eurima (BE), PCE (BE), ES-SO (BE), EuroAce (BE), FIEC (BE), Acciona I (ES)

Subcontractors:
Kaunas University (LT), University of Budapest (HU), University of Bucharest (RO), BRE (UK), UCD (IE)

Link: www.asiepi.eu

Original text language: English

Member states should be encouraged to apply passive requirements reffering to building design or elements that reflect the specific national building traditions and climate conditions. This means they cannot be fixed uniformly across Europe. [4,5]

10 > Conclusions

It is clear that EU MS have been, and still are, facing similar issues with the implementation of the EPBD. The actual list of issues that have arisen for discussion during the first stages of implementation is of course not restrictive. However, some of the most common ones are discussed in this paper in order to share experiences and knowledge. We have seen that for each barrier faced, several approaches are possible. There is no uniform solution that fits all the needs. Some of the examples given in this paper show how technology and regulations should serve a combination of specific (country or building related) needs (in terms of energy efficiency, indoor climate, safety etc.) and not simply exist or be adopted inspite of them. It is therefore up to the countries to judge which approach best fits the national boundary conditions and best serves the objectives for a sustainable future.

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Disclaimer: ASIEPI has received funding from the Community's Intelligent Energy Europe programme under the contract EIE/07/169/SI2.466278.