Energy Performance Certification in Portugal as a tool to achieve real energy savings in buildings

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ABSTRACT: The National System for Energy and Indoor Air Quality Certification of Buildings (SCE) came into force on 1st July 2007. This marked a new phase in the current legislation on energy efficiency of buildings in Portugal and was a direct result of the national transposition of Directive 2002/91/EC. By the end of June 2009, more than 100 000 energy certificates were registered on a web based central registration system that qualified experts must access and use to issue certificates. About 80% of these certificates are of existing buildings and were issued in the first six months of 2009. Around 3 000 certificates for new buildings and 15 000 certificates for existing buildings are issued every month, covering nearly all the licensing and selling processes that take place in the country. This way, a national database of certified buildings is being fed with information that is being useful to monitor progress of different aspects of the implementation of the Directive, from basic statistics such as the number of certified buildings, to impact assessment, including estimated savings. By analyzing the certificates issued in Portugal for existing buildings in the first 6 months of 2009, we can see that about 40% are rated above the threshold for new buildings (B-). If all the recommendations for improvements made by the experts in each certificate were actually implemented, then about 86% of the existing buildings would have, at least, the same energy performance as new buildings (in terms of primary energy consumption per square meter of floor area). For that, an average investment between €1250 and €6500 per building would be required, for an average payback period for investment of 6 to 11 years. And, in this scenario, Portugal could save about 0,4 toe of primary energy per building per year. Although theoretical, this analysis emphasizes the importance of implementing the recommendations made by the experts in the certificates and how these measures need to go from paper to practice. Therefore, it's now time to move from paper to practice. A number of programs and actions are being prepared to take real action and lead to actual implementation of the expert's recommendations, particularly in the framework of building's rehabilitation. Only through these actions the -/goals of the Directive will be reached and real energy savings -/can be achieved.

1 INTRODUCTION

1.1 *Energy Analysis*

In recent years it has been observed an increase of final energy consumption to a very high rate, particularly in the areas of residential buildings and services. Currently, the buildings (residential plus services) account for about 30% of global energy consumption in the country.

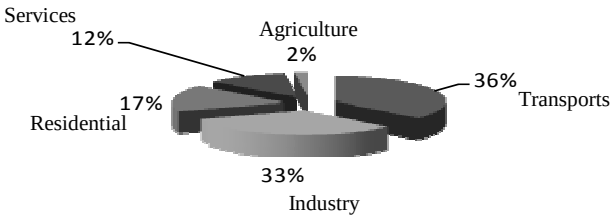

Figure 1. Energy consumption in Portugal

In the European context, it is also the general consensus the need to improve the energy efficiency of buildings. This results of the common concerns of compliance with the Kyoto protocol and the security of energy supplies, in a scenario where buildings account for 40% of global energy consumption. This led the European Commission to move forward in 2002 with the publication of an EU Directive on the energy performance of buildings (EPBD).

Under this Directive, the commission requires that an energy certificate (EC) is issued when applying for the license of a new building, and whenever there is a commercial transaction, sale or lease of an existing building. The certificates should be valid for 10 years and the certification must be provided by qualified experts.

1.2 *EPBD implementation in Portugal*

The partial transposition of the Directive has been put into force in Portugal in April 2006 with the introduction of new legislation that included a review of two existing regulations regarding buildings the RCCTE - Regulation Characteristics of Thermal Behavior of Buildings (DL 80/2006) and the RSECE - Regulation of Energy Systems of Energy in Buildings (DL 79/2006) and the publication of a new decree concerning the certification system for energy and indoor air quality (SCE). For the latter there were published two ordinances, one that sets the timing of the implementation of the SCE (No 461/2007) and the other that defines the registration fees for issuing the EC buildings for housing and buildings services (No 835/2007).

Regarding the scope of application, RCCTE covers all new residential buildings (single-family and multifamily) and small service buildings without HVAC systems or systems with an installed power in air exceeding 25kW. RSECE covers all major commercial buildings, with more than 1000m^2 and 500m^2 in the case of certain specific types such as supermarkets, hypermarkets, shopping centers and buildings with indoor pools and even small commercial buildings and housing with an installed power in air exceeding 25 kW.

The two regulations are in force since July 2006, requiring that new building projects have, on licensing procedures, to integrate the chips and annexes provided, by both RCCTE and RSECE.

The timetable to implement the SCE in the different types of buildings was divided into three phases, starting with new buildings:

- In a first stage, certification was only required for all new residential and non-residential buildings with a floor area larger than 1,000 m^2 and that had construction permits requested after July 1, 2007;
- The second phase included all new buildings, regardless of their floor area, and that had construction permits requested after 1st July 2008;
- The third phase started in January 2009 and meant full implementation of EPBD, that is, all buildings are now included in the certification system: new buildings, major renovations, public buildings and all buildings when sold or rented.

The Energy Certificate (EC) is the most visible aspect of the SCE. This document will give an energy performance (EP) label to residential and non-residential buildings and it may list measures for improving their energy performance.

The energy label in the certificate classifies the buildings on an efficiency scale ranging from A+ (high energy efficiency) to G (poor efficiency). This is similar to the scale currently used for some domestic appliances and equipment (although classes A and B are evenly subdivided in to classes A+, A, B, B-, to improve the distinction among new buildings – all new buildings must be in the A+ to B- classes) and it allows for easy reading and interpretation by the consumer.

ADENE is the managing body of the SCE in Portugal, which is being supervised by the Directorate-General of Energy and Geology and the Portuguese Environmental Agency, and developed a mechanism that allows qualified experts to issue certificates on-line, thus creating a database of all certificates issued. The following is an analysis of that database on the certificates issued until the end of the first half of 2009 relating to residential buildings only.

2 DATA BASE ANALYSIS

Since July 2007 until the end of June 2009, more than 100 000 energy certificates were registered on a web based central registration system that qualified experts must access and use to issue certificates. About 80% of these certificates are of existing buildings and were issued in the first six months of 2009. Currently, around 3 000 certificates for new buildings and 15 000 certificates for existing buildings are issued every month, covering nearly all the licensing and selling processes that take place in the country.

This way, a national database of certified buildings is being fed with information that will be useful to monitor progress of different aspects of the implementation of the Directive, from basic statistics such as the number of certified buildings, to impact assessment, including estimated savings. Such database will also be used to produce information that is useful for the soon to be started process of periodic revision of the technical regulations, where a possible tightening of minimum requirements, as well as a change or optimization of some operational rules, is likely to take place.

ADENE studied the EC issued on the first semester of the year, and concluded that the majority of the dwellings have a C class or lower accordance with the following distribution.

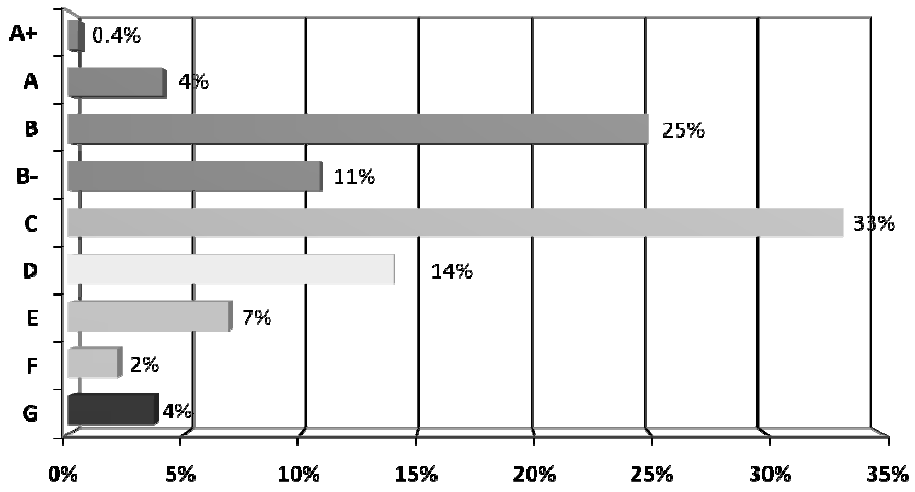

Figure 2. Energy Certificates in Portugal in existing dwellings

As already stated, the new buildings have requirements and are subject to rigorous scrutiny by technical experts, and have to ensure a minimum energy class, contrary to what happens to existing buildings where tenants are responsible for the maintenance and to ensure adequate living conditions. It is thus necessary to examine the reality constructed before the entry into force of this new legislation, to see which buildings have a greater inefficiency.

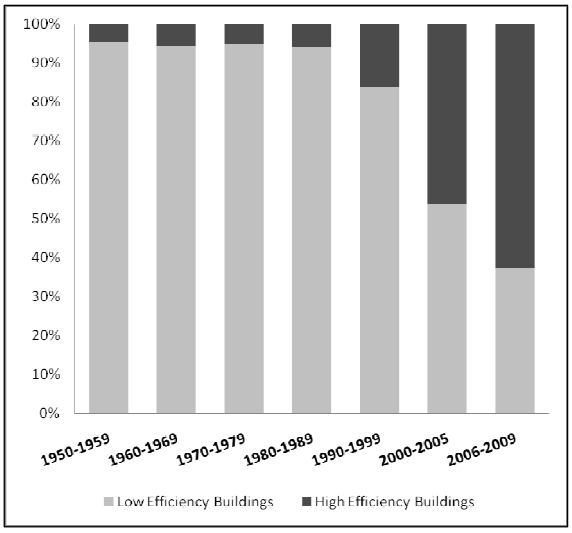

Figure 3. Energy Class Distribution by Decade

Analyzing the different decades, we observed that since 1990 there has been a slight improvement in the energy class caused by the introduction of legislation on the thermal quality in residential buildings, and that the decade with more buildings constructed with lower efficiency is the 70's which is also the decade with more buildings constructed, according to information available in INE - National Institute of Statistics.

Based on this information there is the need to make changes that enable energy savings in homes built in the decades before the implementation of the legislation and to promote improvements in the constructions made in the following decades, in order to get higher ratings than the limit set for new buildings of B-.

One of the most important aspects of the energy performance certificates is the recommendation of improvement measures by the qualified expert. Analyzing the improvement measures recommended by qualified experts in the 1st half of 2009, it appears that the main improvement measures are related to the replacement of equipment for the production of hot water (DHW), heat pumps, glazing, installation of solar thermal collectors and the introduction of insulation in floors, roofs and piers according to distribution presented in the following table.

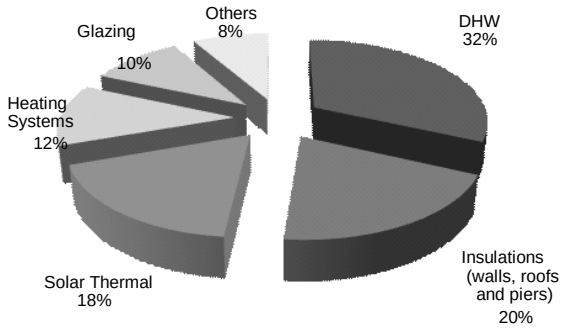

Figure 4. Efficiency measures proposed by the experts

From the database information it was obtained the perception that buildings constructed during the twentieth century require higher measures to become efficient dwellings than those constructed during the present century.

With these measures recommended by experts is possible to obtain significant savings. But how can this be done and move from paper to reality?

3 ENERGY SAVINGS

3.1 *Achieving Real Energy Savings*

The EP requirements for new buildings and major renovations will certainly bring important energy savings in the near future. Maintaining thermal comfort and indoor air conditions will require less energy, as new and renovated buildings become more and more efficient.

But new and renovated buildings only make up a small share of the entire building stock in Portugal (around 5.5 million homes). Currently, less than 50 000 new buildings are built each year in Portugal and, despite the recent growth in the rehabilitation market, major renovations still don't have a significant expression. Therefore, the impact of applying EP requirements in new and renovated buildings is obviously limited and will not lead, in useful time, to a relevant reduction in energy consumption in the building sector.

So, to achieve real energy savings in this sector, there has to be good incentives to the improvement of existing buildings. And certification can play a crucial role in this matter. The recommendations made by the experts in the certificates are important guidelines that the owners of the buildings can make good use of, either in the context of a renovation, or as individual cost-effective measures.

If all the recommendations for improvements made by the experts in each certificate were actually implemented, then about 86% of the existing buildings would have, at least, the same energy performance as new buildings (in terms of primary energy consumption per square meter of floor area). For that, an average investment between €1250 and €6500 per building would be required, for an average payback period for investment of 6 to 11 years. And, in this scenario, Portugal could save about 0,4 toe of primary energy per building per year.

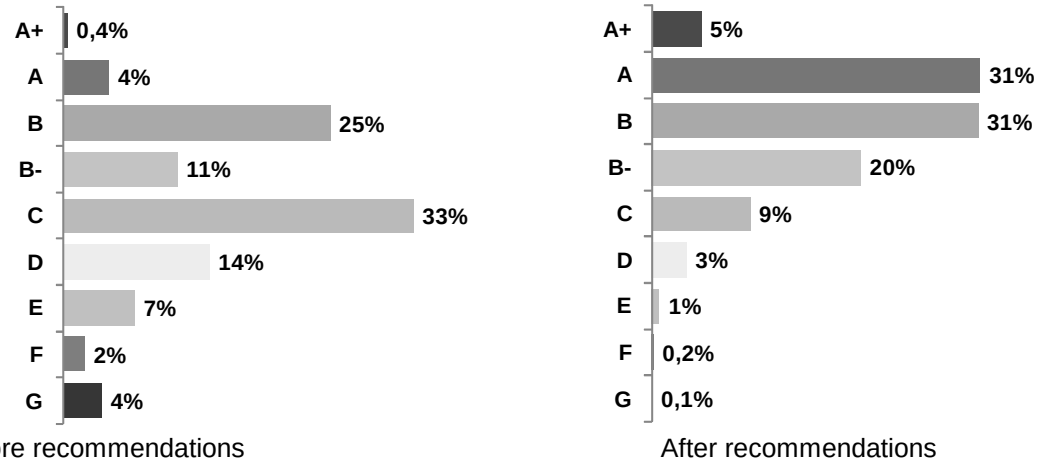

Figure 5. Energy Class Distribution Before/After Recommendations

Although theoretical, this analysis emphasizes the importance of implementing the recommendations made by the experts in the certificates and how these measures need to go from paper to practice.

For that purpose, the National Action Plan for Energy Efficiency (PNAEE), defined by the Portuguese government under the Directive 2006/32/EC, has established the general framework for financial support to specific measures. The exact measures to be supported, as well as the detailed terms and conditions to access that support, are now under definition, taking into consideration the data already available from the database of the certification system.

3.2 *Energy Performance Measures*

We have described the major improvement measures recommended in general terms; however, it is possible to describe the recommendations in more detail. We present some of the improvement measures for each group of application.

Domestic Hot Water Systems
- Hot Water Pump
- High Efficiency Boiler

Insulation
- Thermal insulation on the exterior applied in exterior walls
- Thermal insulation on the inside applied in exterior walls/rooftops/floors

Renewable Energy
- Solar Thermal Collectors

Heating System
- High efficiency boilers for central heating
- High efficiency heat pumps

Windows/Glazing
- Replacement of existing frames maintaining the glass
- Replacement of the glass maintaining the frame
- Replacement of the frame/glass
- Placing an additional frame

These are some of the measures that ensures the increase of the efficiency in residential buildings.

4 DISSEMINATION AND PROMOTION OF ENERGY EFFICIENCY

4.1 *Incentives to promote energy efficiency*

In Portugal the most direct incentives regarding the adoption of energy certification system are fiscal benefits, namely:

- a 10% increase in the deduction related to house loans in the Individual Income Tax for class A/A+ level homes; (national incentive)
- a reduction of 25 to 50% of the Municipality Tax on properties for class A/A+ level homes (until now only in force for houses in the municipality of Lisbon, but others may follow)

Besides energy certification, another incentive promoted by the Portuguese government is the installation of solar thermal collectors. Portuguese government grants a 30% tax credit for investment in renewable energies with a maximum of 796 €, therefore an excellent incentive for reducing energy bills. The micro-generation also has success by ensuring very advantageous electricity tariffs, thus creating a large number of micro-energy producers.

Other measures are being considered such as replacement of glazing and the inclusion of thermal insulation in walls, floors and roofs; however, they all have to be carefully decided, considering they will need an average investment of € 3800. Taking into account the economic period in which we live in, it is difficult for the majority of Portuguese families to support that investment, so financial incentives promoted by the Portuguese government become of vital importance.

In the study promoted by ADENE regarding the improvement measures, the current practices in some countries within the European Union were analyzed, as well as in other developed countries outside EU, such as the United States and Australia. According to the information ga-

thered the following two tendencies were observed: a) Subsidies are the most common incentive applied by the European countries, representing more than 59% of the programmes evaluated; and b) Insulation and heating were the main frequent focuses of the programmes. Within the subsidies it appears that the solutions adopted are subsidized loans and tax incentives, which may take into account the different segments of society benefiting the owners with worst financial situation. Some of these measures are set in PNAEE.

4.2 *Dissemination of energy efficiency*

Although today the consumer is aware of the need to reduce the energy bill and that small gestures provide some reduction of energy consumption, it appears that background action is necessary to rectify the situation more effectively.

One of the problems already identified is the financial issue, due to the need for an initial investment by the owners. Another problem is the need to spread the support programs provided by the Portuguese government and its benefits. This major release should not only be taken by public authorities, but promoted by independent entities with sufficient reliability to the public such as DECO - Portuguese Association for Consumer Protection for example.

Another key player is the qualified expert that relates very closely with the consumer, and can easily advise owners on the best incentives to put into practice the improvement measures he recommends.

Another problem is the lack of knowledge of technologies that despite already being used for a long time in other countries, only now is beginning to have massive use in Portugal. This is a problem for manufacturers and distributors of the product. They have to close this gap and catch up with consumers, providing them with the reliability before and after selling the product.

5 FINAL STATEMENTS

Portuguese household consumers are aware of the current needs on Energy Efficiency and CO_2 emissions and know that there are actions that they can take that will have a considerable impact on those issues.

An important challenge to develop, is training the public to measure the energy use. Recent surveys conducted by leading research agencies point towards the consumer's vulnerability to costs and their lack of awareness as big constraints for the promotion of energy efficiency and renewable solutions in Portugal. Portuguese consumers are very cost oriented and prefer to invest in cheaper technologies, that aren't more environment friendly technologies. Lack of awareness is another big hurdle. Lack of awareness is shown generally in two fronts: 1) consumers are not aware of the amount of energy they are currently consuming in their houses. This makes it difficult for them to understand the benefits of renewable technologies and 2) consumers are not aware of the renewable technologies. This however is slowly reducing due to the government's promotion of these technologies.

On the other hand, additional training should be offered for qualified experts, focusing on issues such as energy audits and best economic and technologic building improvement solutions. The main target is for these agents to stress among citizens that energy certification should not be viewed simply as a cost, and make evidence of the whole idea that making buildings more efficient, results in energy savings and consequently in reduced costs and hence offset the investment.

The impact of applying energy performance requirements in new and renovated buildings is obviously limited and will not lead, in useful time, to a relevant reduction in energy consumption in the building sector. If all the recommendations for improvements made by the experts in each certificate were actually implemented, then about 86% of the existing buildings would have, at least, the same energy performance as a new building, and in this scenario, Portugal could save about about 0,4 toe of primary energy per building per year, what migh, in a best case scenario, represent a 8% reduction of global primary energy consumption.

"One day, all buildings shall be green".

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