Applying the EP label tools for energy certification of buildings in Greece

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ABSTRACT

The primary aim of the EP label project was to develop a methodology for energy benchmarking and certification of buildings, based on Operational Ratings, to address the EPBD Article 7.3 requirement for 'Public Buildings' over 1,000 m² to display an Energy Performance Certificate. Within the EP label project, an easy-to-use yet robust system for building owners, occupiers and managers has been developed that produces a provisional energy performance certificate in advance of national legislative requirements being finalised in each Member State.
Energy assessment and certification have been approached in a series of progressive levels, increasingly detailed but requiring more stringent verification procedures, the so-called graduated response methodology. The concept is that assessments can be at different levels of detail within a cohesive framework.
The system has been developed by leading experts on the field of energy performance of buildings, both as an Excel program and a web-based version (EPLabel Online). An impressive feature of the software is that – with EC funding – it is working with the data and languages of fifteen European countries. It is proposed as a reliable and pragmatic way for benchmarking and production of energy certificates which offers sufficient flexibility to support harmonization between the different member states.

1. INTRODUCTION

Buildings account worldwide for more than 40% of the total CO_2 emissions. The European Union has committed to respond to the challenge of climate change caused by the increased CO_2 production through a series of actions. The commitment for substantial improvement in Europe's energy efficiency of buildings plays a key role in this. The EU Directive 2002/91 on the Energy Performance of Buildings (the EPBD) addresses this issue by calling for mandatory regulation of the energy efficiency of new and refurbished buildings as well as the energy certification (labelling) of existing buildings when sold or let. For public buildings which are not subject to sale or let, an extra obligation has been set up to serve as a means to promote energy certification by displaying the energy label in a prominent place (Article 7.3). Energy certification is expected to make building energy use and CO_2 performance clearly visible. Although initially designed for information only, energy certification is expected to raise awareness and provide the drivers for a radical improvement of the energy efficiency of not only new, but also existing buildings and help to transform property markets.
In recent history, Member States have focused their building energy efficiency regulations, and in the rare existing cases also their energy performance calculations, only on Calculated (Asset) Ratings for new buildings and renovations. Most government officials as well as research experts dealing with the energy performance of buildings are therefore familiar with using Asset Ratings for energy performance assessment purposes.
EPLabel however sets out to demonstrate that in existing buildings, a well-designed procedure of energy certification based on Operational Ratings has several important advantages over one using Asset Ratings. EPLabel also aims to highlight the crucial role of Operational Ratings in improving the energy performance of the existing building stock, a topic of increasing priority in many Member States.
Consequently, the EP label project proposes a pragmatic and reliable methodology to produce the energy certificates based on Operational Rating, while at the same time offering the flexibility required to accommodate national diversity when seeking harmonization between member states.
The project is supported by the EC's Intelligent Energy for Europe (EIE) SAVE programme. It began in January 2005 and ended in February 2007. Financial support has also been received from the British government, Department for Communities and Local Government, the UK Sustainability Forum, the three Belgian Regions, the Belgian Federal Public Service Economy, the Swedish Energy Agency, Göteborg Energy and the Finnish Ministries of the Environment and Trade and Industry.
The project team consisted out of ten full partners being: Energy for Sustainable Development UK, the IASA University of Athens Greece, the Stadt-Frankfurt am

Main Energiereferat Germany, the Esbensen Consulting Engineers Denmark, the CIT Energy Management Sweden, the Belgium Buildings Research Institute, the National University of Ireland, Motiva Finland, DHV Building and Industry The Netherlands and CSTB France. William Bordass Associates and Target Energy Services, UK co-assisted the Energy for Sustainable Development in its coordination duty.

2. THE EP LABEL TOOLS

For the purpose of calculating the energy performance of buildings and providing an energy certificate based on Operational Rating, EP Label has developed a standard methodology and software that can be used in any of the participating countries.
The EP label software has been developed by leading experts on the field of energy performance of buildings. It is an easy-to-use yet robust system for the owners, occupiers and managers of public buildings, that produces a provisional energy performance certificate in advance of national legislative requirements being finalised in each Member State.
The EPLabel software has been developed as both an Excel program and a web-based version (EPLabel Online). The EPLabel *Excel* program is aimed at the building energy expert who wishes to gain a deeper understanding of the calculations and algorithms behind the methodology, while the EPLabel *Online* is a simple yet robust to use tool, better suitable for building owners, occupiers and managers who simply wish to calculate the energy performance of their building and produce an energy certificate based on Operational Ratings.
It has also proved highly useful to have two independent programs to reach the same result in terms of validation and bug detection. Furthermore, this arrangement offers the potential for a facility to upload an Excel datafile completed by an on-site assessor for analysis by the Online system.
For each building, the minimum data input requirements are the building type (or types if it is mixed use), its size (floor area) and the annual use of all sources of energy. The software can also take into account special uses of energy, by kitchens or computer suites for example. The calculation makes allowances for the building's location (climate) and variations in year-on-year weather. Users can create a private section of the website in which they can assemble data for their portfolio of buildings, together with year by year energy performance. Users can choose to make the results for their buildings publicly accessible on the website (in addition to any requirement for display in the building concerned).
An important feature of the software is that it is working with the data and languages of at least eight European countries. This required not just a basic translation but also a harmonisation of the meanings of terms in the context of different traditions of building energy assessment, including different ways of measuring the floor area and other essential components of the calculation.
The project developed a common language for the Operational Rating methodology with each of the terms employed translated into national languages using an idiomatic vocabulary. This creates a common understanding of and harmonises the approach to Operational Ratings across the EU. The software is also in full compliance with brand new standards set by the Comité Européen de Normalisation (CEN).

3. TESTING THE SOFTWARE IN GREECE

The EP label software was tested by experienced scientific users in all participating countries. The final testing in Greece was carried out in two phases. *Phase one* was carried out by the Greek project partner (NKUA) and aimed at testing the tool with real buildings from the primary testing building group, namely school buildings. *Phase two* was combined with the conduction of the national workshop. The workshop participants were asked to gather the energy data for their building and try out the software for themselves.
During testing, three aspects of the EP label methodology proved to be of specific importance:
• the building subtype definition boundaries. The definition of the building category should be totally clear and sealed so that no one can affect the results by just changing the building category.
• the specific boundaries and climatic data of each climatic region. The user should have no doubt which climatic region his building belongs to.
• the definition of the area metric to be used. An exact procedure on how to measure for example the buildings surface, but also the exact proportion of surface corresponding to, for example, the number of beds for a hospital, the number of employees for office buildings etc., should be adopted. It has been proven that for example the tested hotel building was firstly graded an H (312 kg CO_2/m^2) when using the total floor area as default value, but when changing the area metric to the number of beds, then the grade changes to G (188 kg CO_2/m^2).
Most important to stress out for every energy certification methodology is that the energy grade by itself still does not say much about the reduction potential of the energy use of a building. A building with grade A, might still have great potential for energy reduction that has to be taken into consideration. So, as the overall energy use of the buildings stock decreases while technology becomes

more and more energy efficient, the benchmarks have to be redefined and recalculated to better fit the market.

4. OVERCOMING BARRIERS FOR THE GREEK MARKET

As deducted from the EP tool testing, the most critical points for the EP label methodology to be adopted in the Greek energy market are:

The availability of benchmarks for the specific subcategory of building, in the specific country or region.

EP label has adopted a methodology where two benchmark values have been implemented: the Rr (regulatory standard) and the Rs (stock median), for both the electricity and fossil fuel use, to be designated for each building sub-type in each country.

The definition of specific categories and subtypes of buildings is often not only related to the specific visible categories but also to the availability of the corresponding benchmarks.

The subcategories should be divided in such order that it makes sense in terms of energy use and special uses to identify a new subcategory of building. According to that procedure one could choose for example for two sub-categories for school buildings in Greece, the public and the private ones, because those two groups differ a lot in terms of construction, use and facilities and thus in energy consumption. On the contrary it is not evident to divide school buildings accordingly to the level of education provided since this aspect does not influence the actual energy use of the building.

Accordingly, within the EP label project and for all six building target sectors in Greece, specific national subcategories have been defined. For each subcategory of buildings, the common specific energy end uses are taken into account, which allows the end user to firstly specify the subcategory of his/her building and secondly to quantify any special energy use which is not already given an allowance. Typical benchmarks are available for quite some sub-types of Greek building sectors. The benchmarks used in the EP label project are median values derived from scientific statistical studies carried out by the University of Athens and namely for some subcategories of school buildings, office buildings, hospitals, hotels and sport centres. Although of scientific quality, those benchmarks are not considered official national statistics from which definite values for medians or quartiles might be generated.

For the moment and since Rr, the reference values typical of the requirements of energy performance regulations for new buildings, have also not yet been defined by the Greek government, Rr has been assumed to be 50% of the stock value Rs, where Rs is the median value for the building stock as described above.

The weather and climate correction procedure

In order to cope with regional climatic variations, it has been necessary to create benchmarks applicable to the regional average climate for each building. This is done by defining climate indices for 18 regions of Greece, eg degree-days for heating to a given base and CSI indices for cooling to a given base. The part of the benchmarks for electrical energy use related to heating and cooling (climate dependent) are defined separately for each subsector, although in most cases where oil is used for heating, all electricity used is non climate related.

Weather correction of the actual energy on the other hand should take into account the differences in weather experienced by the building during the year of the assessment compared with the regional average climate and should also deal with local year-on-year weather variations experienced by the building. As for the Greek situation, year-to-year weather data is merely available to adjust the buildings energy use, so that currently only the climate correction of the benchmark data can be considered. This does not allow the tool to be used for reporting data for more than one year.

The building energy performance definition

The EPLabel methodology recommends that the weighting factors for the energy benchmarks are the same for all buildings in any country.

Therefore it is assumed that the weighting factor for the electrical energy use benchmark is the same as the value used for grid electricity and the weighting factor for the non-electrical (ie fuel/thermal) energy use benchmark is the same as the value used for natural gas. This is not compatible for the Greek situation where natural gas is still used in a very small scale so that the calculations often show strange results, which are difficult to explain to the EP label user. If considered to be desirable, the EP tool can easily be adjusted to fit the Greek situation on this aspect.

5. RESULTS

The most interesting development during the EPLabel project is that before it started only a couple of countries were openly considering the use of Operational Ratings. Now only a few are holding out against their use. EPLabel, and the Europrosper project before it, have played a key role in embedding Operational Ratings within CEN's EPBD Standards and within the EPBD implementation plans of many countries.

The project has made crucial progress with harmonising the approach to operational rating assessments across the EU and developing the use of measured energy bench-

marks - an area that in many member states was not well advanced. Therefore, a common language has been developed for the Operational Rating methodology with each of the terms employed translated into each Partner's national language using an idiomatic vocabulary. This enables the software to operate in each of the eight languages of the Partner countries and creates a common understanding of the method across national boundaries. The Excel and Online proof-of-concept tools are provided in at least eight languages which show how Energy Certificates based on Operational Ratings can be produced for display to the public. The advanced Excel tool is developed for specific use by experts, illustrating a more detailed and insightful approach to Operational Ratings and an associated training course.

EPLabel activities have played a significant role in the evolution of plans for the implementation of EPBD Article 7.3 in four of the participating Member States (UK, Ireland, Belgium and Germany). In four of the other Member States taking part (France, Greece, Sweden and Finland), Operational Ratings are being employed and EPLabel may yet have some influence on implementation plans. In the two Partner countries (Denmark and the Netherlands) where Asset Ratings are being used for the energy certificates to be displayed by Public buildings, the work of EPLabel has been presented to national officials and may be used to inform the development of the procedures needed to identify cost effective energy improvement measures.

The project has covered six sectors: Public administration offices, Universities, Schools, Sports facilities, Hospitals and Hotels. Full details are available in the project website

6. CONCLUSIONS

The EP label methodology has some very strong advantages that make the methodology very attractive to use. Those strong points are the following:

• It allows calculation of the energy performance for buildings with mixed uses. This is of great importance for buildings like hospitals, hotels, big retail centres, shopping centres, universities etc.

• It allows for calculation of the energy performance of buildings with special uses.

• It takes into account renewable energy sources.

• It allows for intercomparison of buildings within a specific region/country or within Europe.

• It is a harmonised procedure for buildings all across Europe.

• It is easy to adjust to a specific national situation.

• It has a simple approach, works for all, in depended of their background, knowledge and level of detail of data input.

• It is based on real data, which makes the results more pragmatic, tangible and understandable.

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