EP label: a programme to deliver energy certificates for public buildings across Europe based on operational ratings through a graduated response procedure

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ABSTRACT

The primary aim of the EP label project is to facilitate the implementation of article 7.3 of the European Energy Performance of Buildings Directive – the display of energy certificates by public buildings – by developing a harmonized methodology for delivery of energy certificates across Europe based on actual measured energy consumption.

Actual measured energy consumption, the so called 'Operational Rating' (OR), is considered to be an easy, cheap and appropriate methodology to use in existing, occupied buildings. Operational rating considers the actual use of the building including management aspects and helps to overcome the gap between design and actual performance.

Energy assessment and certification are being approached in a series of progressive levels, increasingly detailed and informative, but requiring more stringent verification procedures. The idea behind this 'graduated response' is to provide a methodology that easily works for everyone in every case, suiting the knowledge available in each country, sector, building, actor or assessor.

This paper describes the 'graduated response' methodology introduced within the EP label project and proposed as a reliable and pragmatic way for producing energy certificates which offers sufficient flexibility to support harmonization between member states.

1. PURPOSE OF THE WORK

The EP label project addresses Article 7.3 of the European Energy Performance of Buildings Directive – display of energy certificates for public buildings over 1.000 m^2 in a prominent place – by proposing pragmatic and reliable ways to produce the certificates, 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 is due to end in February 2007. The project involves ten full partners and nineteen countries, of which seventeen are EU member states.

The main expected result is to generate energy benchmarks, based on actual energy consumption, for buildings in the following six target sectors: public administration offices, higher education, schools, sports facilities, hospitals and hotels.

2. KEY STEPS FOR PRODUCING A BUILDING ENERGY CERTIFICATE

The implementation of the certification procedure involves providing a summary of the energy use of the building, weighting the diverse energy sources (fossil, electricity, renewables, etc.) employed, reporting the energy performance per m^2, comparing with benchmarks, categorizing the building and reporting the results on a certificate. The key steps to allow for this are as follows:

Step 1: Collection of energy data and calculation of the energy intensity of the building. The energy intensity of the building is actually an Energy Performance Indicator (EPI) being, according to a draft CEN standard, the weighted sum of the annual consumption of all energywares divided by the building's conditioned total floor area. It can be calculated in terms of carbon dioxide emissions, primary energy use, costs, or any other national policy weighted factors, representing the building's energy intensity.

The proposed methodology is based on actual annual energy use of the buildings, the so-called Operational Rating (OR). Operational rating has been shown to be an easy, cost-effective and appropriate methodology to use in existing, occupied buildings. It demonstrates how a building is actually performing, including management aspects, and thus helps to overcome the gap between design and actual performance. The OR, being easily understood, stimulates building owners and energy managers to make immediate reductions in energy use and CO_2 emissions.

Step 2: Defining benchmarks. The benchmarks utilised are actually statistical figures derived from the measured energy performance of the existing buildings stock. They may be the upper (Poor Practice) or lower (Good Practice) quartile of the distribution of the energy use of all assessed buildings, but usually they are the 50% (median) or Typical value, i.e. the middle value in a sorted list.

In practice, this second step of the procedure is often the hardest in energy certification, as reliably measured energy data is rarely available for a representative sample of the building stock in each country. Thus, gathering the energy data on the existing buildings stock, may often prove to be a difficult and time consuming task; for example, meter readings may be only estimates, past energy bills are not available and floor areas are inaccurately measured.

Step 3: Comparison of the building EPI with benchmarks. In order to provide an energy grading for the building (decide upon the building's energy efficiency), its energy performance indicator needs to be compared to the appropriate building benchmarks. For this step, the EPI is placed on a relevant scale in order to calculate the energy Grade or Class. A CEN pre standard recommends a 7 scale grade A to G classification for encouraging a uniform presentation across member states, whilst allowing for local differences.

Step 4: Identification of energy saving measures. The previous steps in certification are only the precursor to the main goal of the EPBD, which is to actually reduce the CO_2 emissions the building stock accounts for. This can be achieved by implementing energy saving measures, either through investment in more efficient materials and systems or by implementing better management and control techniques. Within the proposed methodology, there are three main levels for delivering energy saving measures, namely:

- A standard national list of measures applicable to the buildings sector.
- A semi-automated list of measures, applicable only for the specific building, a procedure that requires the assessor's ability to quantify the applicability and cost-effectiveness of each measure.
- A detailed list of measures applicable for the specific building, derived after detailed appraisal of the technical and financial viability of each measure.

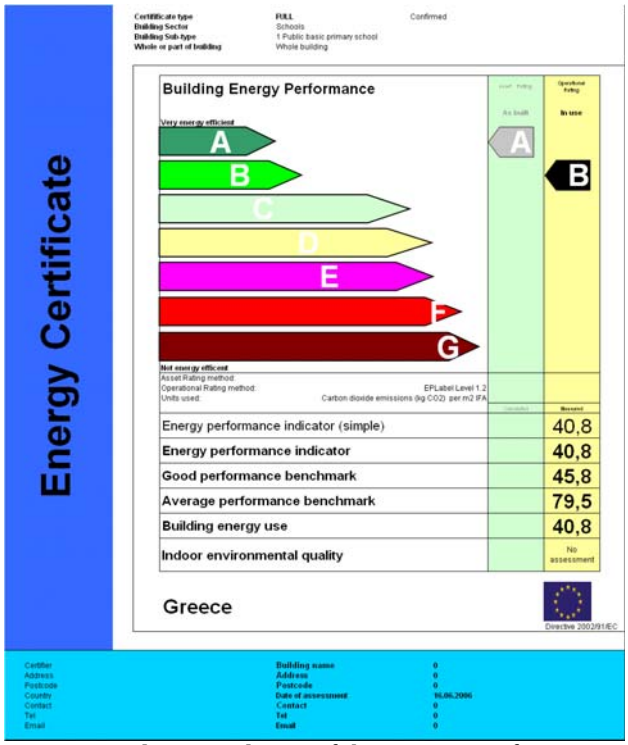


Figure 1: Preliminary design of the energy certificate proposed by the EP label approach.

Step 5: Presentation of energy data and grading results on an energy certificate. The main requirements for the energy certificate are to show:

- The building's background information on its use of energywares and weighted consumption.
- The methodology used to produce the certificate and the organisation providing the assessment.
- The recommended energy saving measures.
- The energy grading of the building.

3. THE GRADUATED RESPONSE METHODOLOGY

The EP label proposed methodology for energy assessment and certification introduces the idea of a 'graduated response', an approach consisting of three harmonised levels of assessment, building up on a progressive manner: each level adds more detail, providing more insight, but requires more input and more stringent verification procedures than the previous one. This allows the level employed to be chosen to suit both the knowledge available for each building sector and type, as well as the resources which the organisation is able to apply. The graduated response offers the following three options:

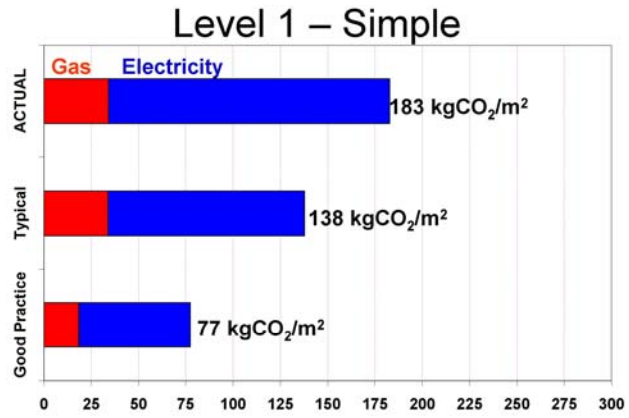
1. Operational Rating procedure

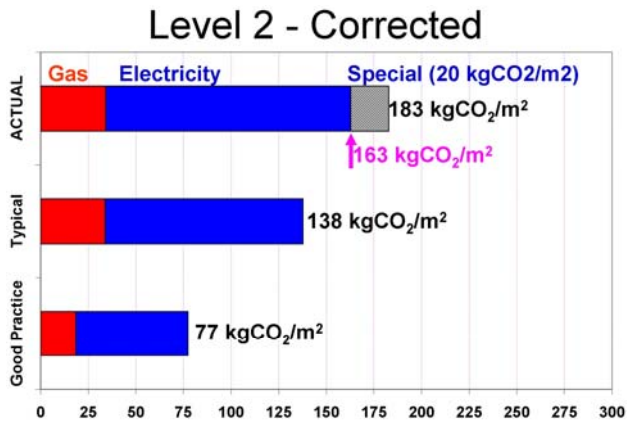
A summary of the energy use and carbon dioxide emissions of the building is presented both on the basis of the energy utilities delivered and the energy consumed by the building.

2. Initial benchmarking procedure

- Level 1: simple, derived from stock statistics for the type of building concerned.
- Level 2: corrected, taking special energy uses into account.

The charts in the right show a building's actual carbon dioxide emissions in comparison





with Typical and Good Practice benchmarks. In the level 2 approach, the emissions stemming from a special energy consuming activity - which is not included in the benchmark reference - are measured and deducted from the emissions total, before this is compared to the appropriate benchmark.

3. Customised benchmarking procedure

- Level 3: customised, taking into account the building's schedule of accommodation, activities and use.

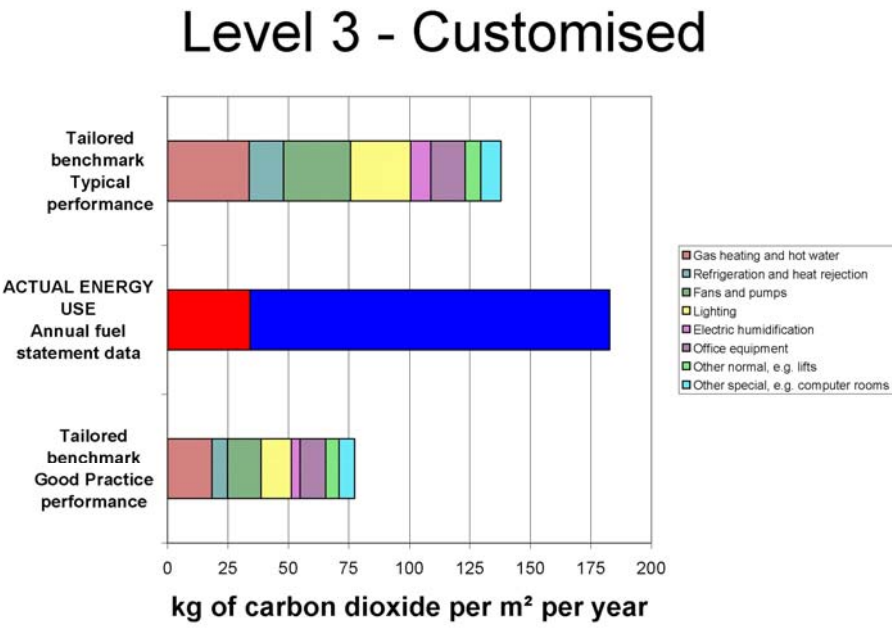
The chart below demonstrates benchmarks built up from each of the energy end uses occurring in the various activity areas in the building concerned. The benchmarks are calculated separately assuming Typical and Good Practice energy consumption for the materials, systems, use and controls involved.

The innovative part of the EPLabel project is the development of the Level 3 benchmarking approach, allowing for more pragmatic and informative assessments of a building's energy use and CO_2 emissions, compared to using bulk energy statistical benchmarks. In future, it may be accredited as an alternative to the Level 2 correction, as long as it remains compatible with the Level 1 and 2 assessments that are most likely to be employed in initial statutory implementations of Article 7.3.

4. NORMALISATION AND CORRECTIONS

In order for the energy consumption of different buildings to be comparable, specific procedures of normalisation and correction must be applied on the available data.

First, a normalisation for the floor area is applied. The chosen normalisation with regard to the building size is uniform for all countries and



consists of converting the national parameters for floor area into internal floor area and dividing the actual energy use by this metric. The use of size conversion factors allows for comparison across national borders. However, if necessary, the results can be presented using a country's preferred alternative floor area metric.

Second, weather and climate normalization methods are applied. The methodology currently adjusts the heating and cooling energy part of the benchmark to reflect the climate of the region where the building is located. The way for doing so varies from country to country depending on the benchmarks available and may include Heating (HDD) and Cooling (CDD) Degree Days per region, or summer and winter Climate Severity Indices (CSI).

However, since the tool is designed to be used for comparison of the annual energy use of a building year to year, it is also important to adjust the actual energy used for heating and for cooling to the regional average climate. This adjustment allows the buildings performance in a specific year to be assessed under the identical climate conditions which apply to the benchmarks: it accounts for the differences in weather experienced by the building during the year of assessment compared with the regional average climate and deals with year to year variations on a specific location.

Besides the above mentioned weather and climate normalisations, it is important to mention that the CO_2 intensity of electricity and other energy sources between different countries may vary significantly. Where, for example, electricity is generated in lignite plants, the CO_2 emitted per kWh produced will be more than in areas where natural gas is employed for electricity generation. For this reason, national conversion factors have been applied within the methodology, allowing for comparison of CO_2 emissions.

5. CONCLUSIONS

The EP label project proposes a reliable and applicable way for Europe to implement a harmonized methodology for energy certification based on Operational Ratings according to the graduated response procedure. An OR accurately shows how the building is performing in practice, thus helping to overcome the gap between design and actual performance.

The graduated response procedure proposes categorising building energy benchmarks into three progressive levels: from simple (derived from stock), via corrected (for special energy uses) to customised (for special energy uses, schedule of accommodation, activities and use).

This approach allows for a fair assessment of the energy use of all buildings, from the simpler ones to the most detailed ones, depending on what is appropriate for each buildings size and complexity as well as on the expertise available in each country. At the same time, it provides a harmonised relation between those levels and a practical approach for their progressive use.

The aim of benchmarking is to make performance visible and provide incentives for real improvement of the energy use of buildings. The entry level should therefore be set at the lowest possible cost, though providing acceptable quality. When energy certification begins to influence the buildings market, the extra assessment and improvement measures will become economically viable tools. Eventually, the market will need to better understand the energy efficiency concepts and respond to stakeholder pressure by planning improvement measures, demonstrating the proven performance of buildings and, ideally, designing more efficient buildings.

Within the scope of raising awareness for energy certification of buildings based on operational ratings, the EP label project has started an initiative to apply the above prototype procedure to buildings used by government organizations responsible for implementation of the EPBD in each country. The aim is to publish the results on the project's website as a preliminary demonstration of public buildings displaying their energy performance.

The EP tool is being translated into eight European languages and is being tested on hundreds of buildings across the participating countries. A special training package is being developed for energy certifiers (accredited experts and inspectors), while a public domain website will demonstrate how to produce an energy certificate based on an operational rating.

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