CEN STANDARDS FOR THE EPBD – CALCULATION OF ENERGY NEEDS FOR HEATING AND COOLING

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ABSTRACT

The European Commission has mandated CEN to produce a set of standards to support Member States for the national implementation of the EPBD. This paper focuses on one of these standards, EN ISO 13790, "Energy performance of buildings - Calculation of energy use for space heating and cooling". It describes the history of this standard which started with a simplified calculation of the energy use for heating of residential buildings only. It describes the current methodology, inclusing heating and cooling, also for non-residential buildings and the 'level playing field' for both simple and detailed methods.

The paper also discusses the issues involving the implementation of the methods in the EU Member States and the prospects for the future.

KEYWORDS

Standardization, energy performance, buildings, calculation procedures, Europe, heating and cooling, energy use.

INTRODUCTION

In Europe, the publication in December 2002 of the Energy Performance of Buildings Directive (EPBD, EPBD 2002) was followed up by a Mandate to CEN to develop a set of standards on energy performance in buildings (M343 2004), to support the EU Member States for the national implementation of the EPBD. More information on the set of CEN standards is given in the so called CEN "Umbrella Document" (CEN/TR 15615 2007)

This paper focuses on one of these standards, EN ISO 13790, "Energy performance of buildings - Calculation of energy use for space heating and cooling".

EN ISO 13790 Thermal performance of buildings - Calculation of energy use for space heating and cooling

EPBD

The EPBD explicitly states that the European Commission intends further to develop standards such as EN ISO 13790 (EN ISO 13790 2003), also including consideration of air-conditioning systems and lighting.

History

In the early '90's of the previous century, the European standard EN 832 (EN 832 1995) was developed, containing a simplified calculation of the energy use for heating of residential buildings. It's follow up was the above quoted EN ISO 13790:2003, including also non-residential buildings.

As part of the Mandate 343 to CEN to support the EPBD, the 2004 version of this international standard has been expanded with the calculation of the energy use for space cooling and additional features (EN ISO 13790 2007).

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New version

In short, the new EN ISO 13790, expected to be published for Formal Vote in August 2007 (EN ISO 13790 2007), gives calculation methods for the assessment of the annual energy use for space heating and cooling of a residential or a non-residential building, or a part of it.

It includes:

- the partition of the building into different zones for calculation;
- the calculation of heat transfer by transmission and ventilation of the building when heated or cooled to constant internal temperature;
- the contribution of internal and solar heat sources to the building heat balance, including recoverable thermal losses from technical building systems such as heating, hot water or cooling systems;
- the effect of thermal inertia (building thermal capacity) and intermittent heating or cooling;
- the annual energy needs for heating and cooling;
- the annual energy required by the heating and cooling systems of the building for space heating and cooling;
- the additional annual energy required by a ventilation system.

Each of these items requires input from other standards, on building components and on technical building systems.

In addition to the **monthly** (and seasonal) method for cooling, also a **simple hourly** method for heating and cooling has been added, to facilitate direct introduction of hourly, daily or weekly patterns (e.g. controls, user behaviour).

Common rules for the boundary conditions and physical input data have been added, also applying to the use of dynamic simulation methods. This creates a **level playing field** irrespective of the chosen calculation approach (see figure 1).

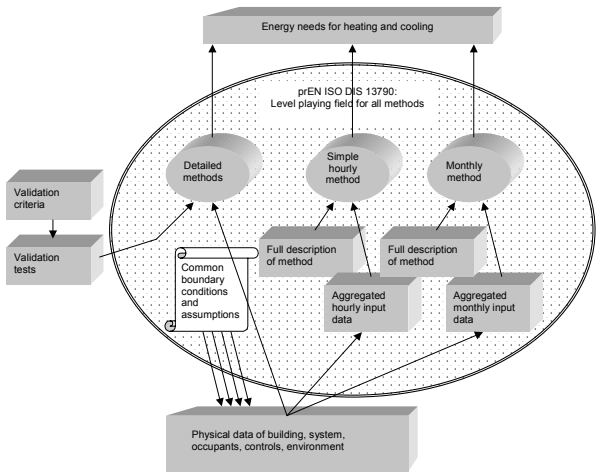

Figure 1. EN ISO 13790: Level playing field for different methods to calculate the energy use for heating and cooling

Special attention has been given to the suitability for use within the context of national or regional **building regulations**. For such applications, it is important that the calculation procedures are

unambiguous, repeatable and verifiable. To accommodate the application for these and other situations, this standard offers different choices. It is up to national bodies whether or not to choose a specific option for mandatory use, e.g. depending on the region in the country, the type of building and its use, and on the purpose of the assessment.

The monthly calculation method is one of the options in the new EN ISO 13790. Figure 2 shows the well-known "gain utilization factor" as function of the heat balance and building inertia. A similar approach, with a "loss utilization factor", has been introduced for space cooling

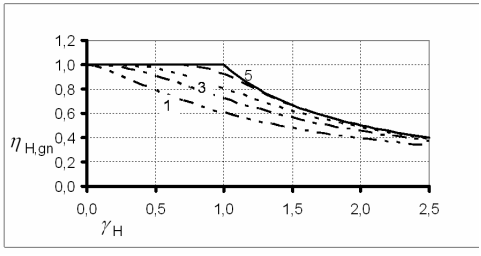

Figure 2. For the monthly or seasonal method: the gain utilization factor as function of the heat balance and building inertia

The simple hourly calculation method is a new option in the new EN ISO 13790. Figure 3 shows the model, represented as an 'RC-network'.

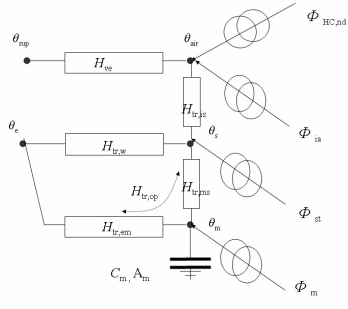

Figure 3. For the simple hourly method: the RC-representation of the model

National implementation

All CEN standards to support the EPBD, assuming that they all pass the Formal Vote, will be available from National Standard Bodies before the end of 2007. They will contain a national cover sheet and, if applicable, national annexes will be incorporated.

EN ISO 13790 is to be published in August 2007 for Formal Vote.

Existing buildings
Special attention is given in EN ISO 13790 on the applicability for existing buildings where normally less detailed information is available for a cost-effective energy performance assessment. Several recommendations from the European project Enper-Exist on this issue have been taken into account (Spiekman 2007).

Important next phase
Regional differences in climate, building tradition and user behaviour in Europe will have an impact on the calculation procedures, the input data and consequently on the energy performance. These differences will also lead to differing approaches in the balance between accuracy and simplicity.
In addition to that, national policy considerations play a role.

When we consider the CEN standards developed to support the practical implementation of the EPBD, they indeed show flexibility to accommodate different applications or objectives and national or regional differences:
Several standards allow choices between different options to be made at national level
Some of the standards contain a (often detailed) reference method and allow national annexes with (often simplified) national methods.
Most standards allow the input data and boundary conditions to be specified at national level.
This is also the case for EN ISO 13790.
More information on these issues is provided in the EPBD Buildings Platform Information Papers (Hogeling 2006, van Dijk 2007a, van Dijk 2007b, Hogeling 2007).

Also, because many EU Member States have only limited experience with integrated EP calculation procedures in the context of building regulations, and assuming there is agreement on the need for further harmonisation between the EU Member States, the work should incorporate **feedback from practical experiences** and **cross comparisons** of the existing different approaches in the Member States during the next few years.

The existing and new Intelligent Energy Europe projects, together with the EPBD Concerted Action and the EPBD Buildings Platform will play an important role in the increased awareness and effective use of the standards and in obtaining the necessary feedback from the Member States and users, aiming at further improvement and harmonization.

Four new proposed projects related to standardization
New projects have been proposed for funding by the Intelligent Energy Executive Agency (IEEA, later renamed into Executive Agency for Competitiveness and Innovation, EACI, an agency of the European Commission), with prospected starting dates in autumn 2007. The most relevant for the standardization activities is the proposed project **CENSE**. The project CENSE aims to support the EU Member States and other target groups in the awareness and effective use of the CEN standards to support the EPBD, to collect and analyse their experiences (barriers, good practice examples) and to prepare recommendations to CEN for improvement and further harmonisation.

The global perspective: ISO
Practical tools in the form of standards are also needed at global level. Consequently, there are also initiatives in ISO on standardization of energy performance of buildings. Some of the developed and/or updated EPBD CEN standards have already been voted in parallel. This means that these standards are CEN standards and ISO standards at the same time. This includes EN ISO 13790, as well as the series of standards dealing with thermal transmission properties. This work is done in parallel in ISO Technical Committee TC 163, "*Thermal performance and energy use in the built environment*". Also other ISO Technical Committees are preparing draft standards that are related to the energy performance of buildings, e.g. in ISO/TC 205, "Building environment design".

It is expected that more of the current EPBD CEN standards may be adopted by ISO/TC 163 too. This means that the current EN's may become EN ISO standards as well. This could be done without changing the technical content of the current EN's.

Global consensus on such methods provides transparency for all interested parties. It enables meaningful comparisons of actual energy use and the potential of energy saving and renewable energy technologies at a global level. This is essential for international cooperation to solve the environmental and climate change problems.

THE EPBD BUILDINGS PLATFORM

The EPBD Buildings Platform is an initiative from the Intelligent Energy – Europe Programme of the European Commission. The Platform's website: www.buildingsplatform.eu (figure 4) contains detailed information on the calculation methods, but also on the other themes of the EPBD, publications and software databases and information papers on various EPBD related topics, including national reports on the status of the implementation.

Figure 4. The home page of the EPBD Buildings Platform

CONCLUSIONS

The European Commission has mandated CEN to produce a set of standards to support Member States for the national implementation of the EPBD. This paper focused on one of these standards, EN ISO 13790, "Energy performance of buildings - Calculation of energy use for space heating and cooling". It described the history of this standard which started with a simplified calculation of the energy use for heating of residential buildings only. It described the current methodology, including heating and cooling, also for non-residential buildings and the 'level playing field' for both simple and detailed methods.

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