

PROJECT DOCUMENT

Status: PUBLIC

Summary of Results and Recommendations derived in Workpackage 3 “Building Energy Performance” of the CENSE-project:

CEN standards on Lighting (EN 15193), Energy Use for Heating and Cooling (EN ISO 13790) and on Thermal Transmission (EN ISO 6946, 10077, 10211, 10456, 13370, 13786, 13789, 14683; EN 13947)

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<CENSE_WP3.3_N05>

May 31, 2010

IEE-CENSE

*Leading the CEN Standards on Energy Performance of Buildings to practice
Towards effective support of the EPBD implementation and acceleration
in the EU Member States*

Supported by

Intelligent Energy  Europe

Contract EIE/07/069/SI2.466698

Contents

1	Introduction.....	3
1.1	Introducing the CENSE-Project.....	3
1.2	This report's content.....	3
2	Results regarding the CEN-standard on lighting: EN 15193	4
2.1	Summary	4
2.2	Recommendations	4
3	Results regarding the CEN-standard on energy use for heating and cooling: EN ISO 13790	5
3.1	Summary	5
3.2	Recommendations	7
4	Results regarding the series of EN ISO standards on thermal transmission properties of building components and building envelope – EN ISO 6946, 10077, 10211, 10456, 13370, 13786, 13789, 14683; EN 13947	8
4.1	Summary	8
4.2	Recommendations	9
5	Bibliography.....	10

Disclaimer:

CENSE has received funding from the Community's Intelligent Energy Europe programme under the contract EIE/07/069/SI2.466698.

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1 Introduction

1.1 Introducing the CENSE-Project

The “Energy Performance of Buildings” Directive (EPBD) of the European Commission aims at allocating substantial energy saving potentials in the European building sector. In support of the EPBD, the European Commission mandated the European Committee for Standardization (CEN) to develop a set of standards providing methods which allow to analyze, optimize and rate the integrated energy performance of buildings, including lighting.

Although these standards have been available for quite a while now, many of them are not yet or not yet fully implemented in the Member States and most of them are hardly known among experts and practitioners. In order to improve acceptance and use of the CEN-standards and to accelerate their implementation on a national level, the project IEE-CENSE with 13 partners from eight different countries was initiated by the Commission.

Within the CENSE project, a series of questionnaires on the practical use of the CEN standards was developed and sent to contact persons in the EU Member States. In addition several presentations and workshops were held discussing the standards and their content. All these actions were aiming at the identification of specific problems arising from

- the content of the standard (i.e. degree of complexity, completeness, practical relevance, ...)
- the implementation of the standard (i.e. national regulations, no software, ...)

1.2 This report's content

In the following, the results of all investigations within Workpackage 3 (WP 3) “Building Energy Performance” of the CENSE-project are summarized. This includes conclusions derived from the evaluation of questionnaires as well as those obtained during workshops and in conferences, where the respective issues were discussed. The most important results are the recommendations, which will be given to CEN for improvement of the standards. The improvements could for instance take the form of a second revised generation of CEN standards.

The issues covered in WP 3 are:

- **Lighting:**
EN 15193: Energy performance of buildings - Energy requirements for lighting
- **Energy use for heating and cooling:**
EN ISO 13790: Energy performance of buildings – Energy use for space heating and cooling
- **Calculation of heat transmission:**
Series of EN ISO standards on thermal transmission properties of building components and envelope: EN ISO 6946, 10077, 10211, 10456, 13370, 13786, 13789, 14683; EN 13947

For each of these issues, a separate report is available describing in more detail the inquiries made and their results [1, 2, 3]. These documents and other information, e.g. detailed information on the CEN standards, but also the results and recommendations on other clusters of CEN standards for the EPBD and summarizing final reports, can be found at the project's website www.iee-cense.eu.

2 Results regarding the CEN-standard on lighting: EN 15193

2.1 Summary

The development of the European CEN standard EN 15193 on lighting energy can be regarded as a big step forward concerning the implementation of energy efficient lighting concepts. It offers a useful umbrella framework of different methods and ways to determine lighting energy needs. Nevertheless, the feedback from a European inquiry process within the CENSE-project (questionnaire and workshops) on acceptance and applicability of the standard suggests that further improvements should be considered within the next review phase of the standard. Editorial and structural clarifications should be tackled as well as some technical aspects, which have not yet been addressed sufficiently.

The standard EN 15193 was investigated by discussions in workshops and a questionnaire. The questionnaire's evaluation shows that though lighting requirements have been defined in most European countries, only few countries did actually put the CEN standard into force; also, awareness of practitioners is still low. In general, the standard is regarded as a useful umbrella document and its methods are considered to be applicable and helpful. Nevertheless, parts of the standard are rated being not easy to understand. Although many essential parameters in the determination of lighting energy needs are covered, some additional aspects should be addressed in a revised version. Providing, for instance, methods to rate lighting controls in more detail, to determine the installed power of new lighting installations and to rate the impact of sunshading devices on the lighting energy demand might help to further improve the standard's quality and acceptance.

A simple means to raise acceptance seems to lie in a review focusing on structure and editing in order to clarify and simplify parts of the document. Particularly the presentation of equations should be reorganized, for instance by adding a list of the variables used to each equation and by describing connections to other equations, making them more understandable. An example of technical aspects still to be addressed is artificial lighting, which is only taken care of in existing buildings in the current version of the standard. Consequently, an additional approach covering the lighting design in new buildings needs to be developed, and a simplified method should be included. Also the effect of lighting controls should be considered in the calculation method as well as the impact of glare and sunshading protection on lighting energy demand. By providing extra material with simplified explanations and background information, the readers' ability to understand and apply the standard could be further enhanced as well as their awareness of the methods underlying available computer software.

2.2 Recommendations

In consequence of the results mentioned above, the following recommendations for a review of CEN standard EN 15193 are given:

- Review of the standard's structure and editing of the equations.
 - A clear structure, which separates common procedures and national choices, is essential to make the document easily understandable. Regarding this issue, a common structure of all CEN-standards should be aimed at.
 - The current layout of the standard with numerous stand-alone equations and with a lot of detailed information in the annexes requires a lot of going back and forth in the document when applying the methodology. Especially the editing of equations is crucial. They should be fully spelled out, using common symbols, terms and definitions and be followed by a list of variables used. Input/Output-links between equations should also be provided.
 - The reduction of typing errors should be a positive side effect of the review process.
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- Technical extensions of the standard's methodology, covering the following issues:
 - A simplified method to rate the installed power of new buildings in the design phase. In its current version, the standard focuses on the installed power in existing buildings only. An appropriate method is introduced in Annex A.
 - A method to rate the energy impact of sunshading systems, especially of moveable devices. In Annex B a detailed method is suggested.
 - A more distinguished scheme for daylight-responsive controls of artificial lighting. Annex C contains an applicable method.
 - Additional representative climatic data, especially for climates of the Northern latitudes.

For most of these aspects, corresponding methods have evolved within the last few years that can directly be included into the standard's annex with moderate effort. Some applicable methods are introduced in this report's Annex, as mentioned above.

- Control and revision of the benchmark values.

Research results and practical experiences show differences in the benchmark values given. These differences should be discussed and eventually be adapted. In Annex D, an exemplary graph is presented, which shows a clear difference compared to the values provided in the current version of the standard.

In addition, for a better understanding and improved application of the standard's methodology additional information material is asked for. As this is not the function of a standard, it is not considered a recommendation in this report's context. Nevertheless, possible options are to provide design guides with example calculations and background information, for instance included in software implementing the standard's method or by national organisations.

3 Results regarding the CEN-standard on energy use for heating and cooling: EN ISO 13790

3.1 Summary

EN ISO 13790:2008

One of the series of questionnaires was on the application of CEN(-ISO) standard "EN ISO 13790: Energy performance of buildings – Calculation of energy use for space heating and cooling".

The EPBD explicitly states that the European Commission intends further to develop standards such as EN ISO 13790, also including consideration of air-conditioning systems and lighting. Consequently, as part of the Mandate 343 to CEN to support the EPBD, the EN ISO 13790:2008 version was written, replacing EN ISO 13790:2004 (which already had replaced the well-known EN 832).

EN ISO 13790:2008 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.

The questionnaire

The questionnaire was designed in two parts: a simplified questionnaire, as email, which contained a few questions and could be answered within a couple of minutes; plus a more detailed questionnaire as M.S. Word file, on specific technical details.

The combination of these questionnaires aimed at inquiring the status of implementation of the standard in the different member states of the European Union. The evaluation of the questionnaires

should provide information on future efforts to make the standard better known and accepted and on necessary contents for revising the standard in order to allow a broad application in daily design practice.

The questionnaires were sent out to contact persons identified within the CENSE project from the 27 EU Member States as well as Switzerland. From representatives of the 14 EU Member States a completed short and/or detailed questionnaire was returned.

Main results of the questionnaire

The main results are the following:

From all responding countries the national building regulations do ask for a kind of procedure as laid down in EN ISO 13790 and consequently this standard is very relevant for them.

In none of the responding countries EN ISO 13790:2008 is used directly, but in all responding countries indirectly, by copying parts of it in their national standards or building codes.

There is no operational obstacle to put this specific CEN standard in force by the national/regional regulations. But the timing of the preparation of CEN standards did not coincide with the timing decided at national level (from project plan to implementation in the law and application in practice).

It is true that it already requires a lot of time and energy to agree nationally upon the national method, thus adding a CEN circuit would only mean more time and effort and added risk that the procedures are not available in time or do not describe what is nationally needed. Therefore, a transparent planning of revisions of these CEN standards (when and what) would be helpful. It would also help if people involved in the national or regional building regulations become involved in the CEN standardization activities.

All respondents declare the structure of the standard EN ISO 13790 clear and understandable. But the standard contains many choices to be made or to be worked out with more detail at national level.

The standard covers all relevant issues; it does not need to contain a more concrete method or to provide more normative options to choose or to be more detailed or less detailed.

Opinions are divided if the number of options to choose from should be reduced: withdrawing them would cause problems to specific countries where several of the options are used.

In most countries there are no or only minor elements conflicting with EN ISO 13790, a benefit of the variety of options that EN ISO 13790 offers.

Many respondents state that they need a national method that is compact; consequently they integrated selected parts from this specific CEN standard/cluster of CEN standards. It is easier and gives higher quality / consistency if a national method is written that is based on the CEN standard (because of the many choices to be made or to be worked out with more detail at national level).

The volume of the informative annexes to the standard makes the standard unnecessary thick, over-complex and sometimes less relevant for the user. National standardization institutes are obliged to include all informative annexes even if they are of no relevance for national conditions.

The awareness of calculation methods covering passive issues can be rated alright but with a noticeable potential of improvement, as some countries' participants indicate a low awareness focussed on researchers. In general most passive systems are not explicitly covered in the CEN-standard, but influence the calculation methodology on different stages; especially new technologies are missing. It would be very effective to explicitly display the contribution of passive systems (which indeed directly influence the energy performance of buildings) to the overall energy needs on energy performance certificates.

Additional feed back from workshops

In the course of the project several workshops were organised, focussing on discussions to additionally receive feed back and / or further results on the issue. Consequently the (preliminary) results of the questionnaire were intended to serve as base for an intense discussion. In particular it was tried to identify and discuss problems arising from the content of the standard and its implementation.

In general, the workshops underlined the conclusions from the questionnaire.

In addition, at some of the workshops presentations were given on national or regional implementation of EN ISO 13790 and other standards. There the recommendations derived within the CENSE-project were accentuated and in addition interesting details on experience, national practice and proposed improvements were provided. As part of the preparation of the development of a second generation of CEN standards on the energy performance of buildings, it is important to take these into consideration.

3.2 Recommendations

In consequence of the above results obtained by the inquiries made and discussions at several workshops with target groups, the following recommendations for a review of CEN standard EN ISO 13790 are given:

- Review of the standard's structure:
 - A clear structure, which separates common procedures and national choices, is essential to make the document fit for use as normative document and to enable the introduction of a brief and transparant (normative) National Annex that comprises the national choices, boundary conditions and input data. The National Annex thus controls the national (or regional) application of the standard. Regarding this issue, a common structure of all CEN-standards should be aimed at.
 - The need for a compact national document can be accomodated by an (informative) national Application Document that has the same content as the (normative) CEN standard plus (normative) National Annex, but re-edited, integrating the common and national elements.
 - The obstacle formed by the big volume of informative annexes for national implementation (translation, conversion, status) can be removed by moving all informative annexes to a separate Technical Report, accompanying the standard.
 - The link with other standards can be made more explicitly clear by introducing flow charts and overviews of input and output variables.
 - A spreadsheet with worked examples should be available together with the standard, for testing, benchmarking and validation.
- Technical extensions or improvements of the standard's methodology, covering e.g. the following issues:
 - General:
 - More explanations on partitioning the building into calculation zones.
 - Extra natural or mechanical ventilation for cooling and solar shading controlled on outdoor or indoor climate.
 - Check intermittency correction factors for the monthly method (and link with validation according to EN 15265); check extra radiation to the sky.

- Add simple procedure to account for the effect of spatial levelling of internal temperature in dwellings, as function of specific heat losses.
- Add double envelope and interactive façades.
- Add principles on to what level of detail it still makes sense to introduce correction factors in a simplified monthly method, as opposed to changing over to a (simple or more detailed) hourly method.
- Add list of details that need to be harmonized to ensure reproducibility for detailed methods.
- Passive Heating and Cooling (to increase awareness and successful use of passive systems):
 - Include and explicitly cover aspects and systems for passive heating and cooling in the calculation methodology, for example double skin facades and ground-coupled heat exchanger (earth tubes)
 - Support the clear display of passive contributions on Energy Performance Certificates
- Development of performance characteristic values of building elements, including the contribution of passive heating, cooling and daylighting, to support the energy labeling directive (e.g. windows)
- Consideration of results from additional relevant research projects, for example of further IEE-projects. Regarding double skin facades the IEE-project “BestFacade” provides an appropriate calculation procedure as well as an information database, a design guide and default values. Whereas within “ENPER EXIST”, special needs for the assessment of existing buildings were investigated.

4 Results regarding the series of EN ISO standards on thermal transmission properties of building components and building envelope – EN ISO 6946, 10077, 10211, 10456, 13370, 13786, 13789, 14683; EN 13947

4.1 Summary

The questionnaire

The questionnaire was designed as a simplified questionnaire, as email, which contained a few questions and could be answered within a couple of minutes.

The evaluation of the questionnaire should provide information on future efforts to make the standards better known and accepted and on necessary contents for revising the standards in order to allow a broad application in daily design practice.

Because of the limited time remaining available for the preparation and follow up on this questionnaire until the end of the project, the questionnaire was sent out only to specific known contact persons in 10 countries, as these personal contacts would make it likely to receive response at short notice without excessive persuasion. From representatives of 7 EU Member States a completed questionnaire was returned, plus one less detailed preliminary response.

Despite the limited number, the available responses were significant enough to indicate some trends.

Discussing the main results of the questionnaire

In all of the responding countries the subseries of EN ISO standards on transmission is used in one way or the other. In some of the responding countries this subseries of EN ISO standards is used directly: they are referenced in the national building codes. In other responding countries this subseries of EN ISO standards is used indirectly, by copying parts of it in the national standards or building codes. In most countries there are some specific elements conflicting with this subseries of EN ISO standards. We recommend that, as part of the preparation of the second generation of CEN standards for the EPBD, these deviations are analysed to see if there is a need to revise the CEN standards.

The subject of thermal transmission properties of building components and building envelope is one of the subjects related to energy saving in buildings with the longest tradition in national and international standardization. In consequence, international standards in this field have already been in existence for many years. But it also means that in many countries there exists a long tradition in national standardization in this area, focusing on the specific national situation: building tradition, building inspection, building insulation levels, etc.

The two main reasons mentioned for not (directly) using this subseries of EN-ISO standards in the national building regulations are: the tradition of having national standards in this area and the advantages of an all-in-one document (as one country describes): a coherent and accurate document prepared by a well-organised group of national experts, which includes all national choices and input data.

The questionnaire did not address technical details. Only concerning the strongly revised standard EN ISO 13370 (calculation of the heat transfer via the ground) the respondents were asked about their experiences. There, it seems that the specific question on new procedures to calculate the heat transfer via the ground came a bit too early, because these new procedures are not yet implemented widely. One point of attention seems to be the quantification of the impact of linear thermal bridges in the foundation. Because in several countries, the linear thermal transmittance values are given in a so called "thermal bridge atlas", the validity of this element in the new procedures in EN ISO 13370 is a point of attention.

4.2 Recommendations

Despite the limited number of responses, the available answers were significant enough to indicate some trends. This led to the following recommendations regarding the standards' structure:

- A clear structure, which separates common procedures and national choices, is essential to make the EN ISO standards fit for use as normative document and to enable the introduction of brief and transparent (normative) National Annexes that comprises the national choices, boundary conditions and input data. The National Annexes thus control the national (or regional) application of the standards. Regarding this issue, a common structure of all CEN-standards should be aimed at.
- The need for a compact national document can be accommodated by an (informative) national Application Document that has the same content as the (normative) CEN standard plus (normative) National Annex(es), but re-edited, integrating the common and national elements.

Regarding technical details, due to the reasons mentioned above, concrete recommendations can currently not (yet) be given. Nevertheless, one point of attention became apparent: the quantification of the impact of linear thermal bridges in the foundation in EN ISO 13370. In general, because in most countries there are some specific elements conflicting with this subseries of EN ISO standards, we recommend that such deviations are analysed to see if revision of the CEN standards on these issues would improve the standards and increase their direct use in the context of the national building regulations.

5 Bibliography

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