Energy Performance of Buildings

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PROJECT DOCUMENT

Status: PUBLIC

Report on the Application of CEN-standard EN ISO 13790: Energy performance of buildings – Calculation of energy use for space heating and cooling

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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

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Contents

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1 Executive Summary and Recommendations

1.1 Executive Summary

The CENSE project

The CENSE-project was initiated by the European Commission to improve acceptance and use of the CEN-standards, which were developed to analyse the energy performance of buildings according to the EPBD. One of the project's major goals is to identify problems concerning the standards' content and their implementation via questionnaires and workshops and to formulate recommendations for improvement.

EN ISO 13790:2008

One of the series of questionnaires is 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 is 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 questionaires 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 projectplan 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 reasearchers. 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.

Finally: harmonization simply takes time…. but with a good set of conditions the process can be significantly accelerated.

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 of an intense discussion. In particular it was tried to identify and discuss problems arising from the content of the standard and its implementation.

Additional feed back from workshops

In this report we included brief reports on a selected series of workshops that were specifically relevant for EN ISO 13790.

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

In addition, at some of the workshops presentations were given on the national or regional implementation of EN ISO 13790 and other standards which underline the recommendations, but provide very interesting details on the experience, national practice and proposed improvements. 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.

1.2 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

o Development of performance characteristic values of building elements, including the contribution of passive heating, cooling and daylighting, to support the energy labelling directive (e.g. windows)

o 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.

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

In addition, at some of the workshops presentations were given on the national or regional implementation of EN ISO 13790 and other standards which underline the recommendations, but provide very interesting details on the experience, national practice and proposed improvements. 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. Details are given in chapter 5 of this report.

2 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 implemented in the Member States and most of them are hardly known among experts and practitioners. In order to improve acceptance und 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 is developed and sent to contact persons in the EU Member States. In addition several presentations and workshops are held discussing the standards and their content. All these actions are 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, ...)

3 CEN-ISO standard 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, also including consideration of air-conditioning systems and lighting.

History

In the early 1990's the European standard EN 832 was developed: "*Thermal performance of buildings - Calculation of energy use for heating - Residential buildings*". Its follow up was the above quoted EN ISO 13790:2004, including also non-residential buildings.

As part of the Mandate 343 to CEN to support the EPBD, the 2004 version of this international standard was expanded with the calculation of the energy use for space cooling and additional features leading to EN ISO 13790:2008.

New version in 2008

In short, the new 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.

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 was 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 were added, also applying to the use of dynamic simulation methods. This creates a **level playing field** irrespective of the chosen calculation approach (see figure 3).

Special attention was 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. The next figure shows the well-known "gain utilization factor" as function of the heat balance and building inertia. A similar approach, with a "loss utilization factor", was introduced for space cooling.

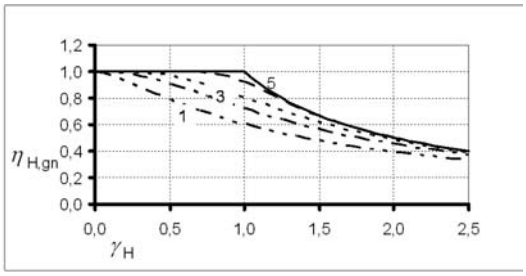


Fig. 1 — Gain utilization factor curves for the monthly method; similar curves, for the loss utilization factor, are given for space cooling

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

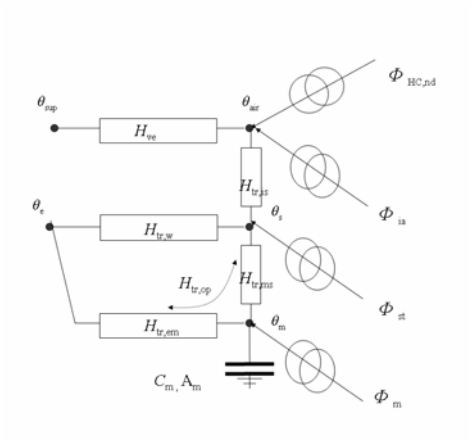


Fig. 2 — The simple hourly method, represented as an 'RC-network'

The following figure illustrates the level playing field for the different calculation methods provided in EN ISO 13790.

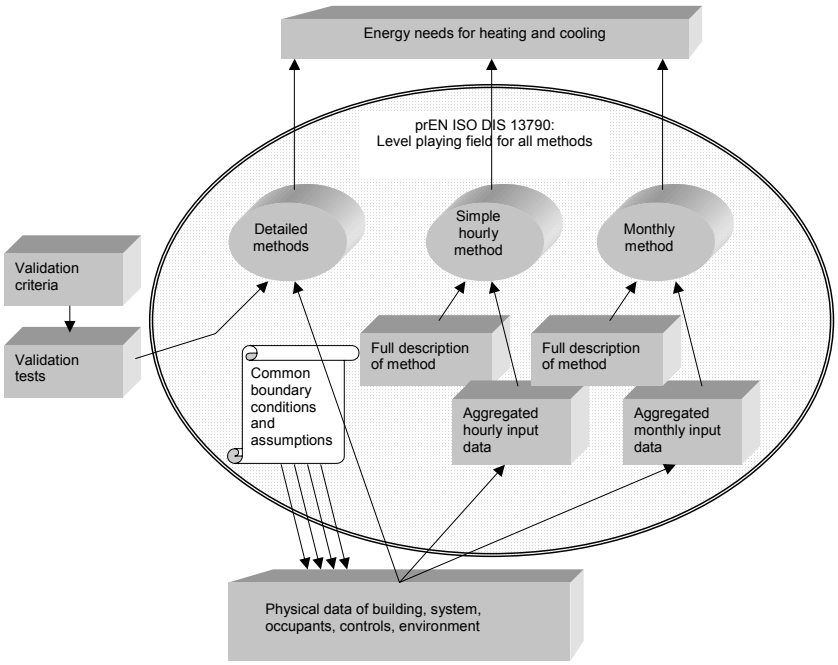


Fig. 3 — EN ISO 13790: Level playing field for different methods to calculate the energy use for heating and cooling

More information on EN ISO 13790:2008 can be found in the CENSE Information Papers P92 [2] and P93 [3].

4 The Questionnaire on EN 13790

4.1 Introduction

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

It is designed in the following way:

Knowing that the persons who are capable to give the requested information are as a rule extremely occupied, we split our questionnaires in two parts:

- Part 1: as email, which contained a few questions and could be answered within a couple of minutes

- Part 2: Attached to that email an M.S. Word file containing a questionnaire on specific technical details (which could also be downloaded from the project website).

We asked the contact persons to quickly answer the questions of Part 1, by simply typing in their reply-email. We also asked them, if possible and if applicable, to complete also the attached more detailed questionnaire.

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.

For better assessment, the more detailed questionnaire starts with some questions about identification and personal background. The next question is, whether the current or the near future situation is considered (near future is more interesting for the purpose). The following general question enables the respondent to generally evaluate the standard and possible changes required. Regarding the national implementation of the standard, questions about policy and legal boundary conditions are covered next. General technical and content based issues are followed by questions about passive heating and cooling.

The questionaires 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 following 14 EU Member States a completed short and/or detailed questionnaire was returned: Austria, Switzerland, Czech Republic, Denmark, Finland, France, Germany, Italy, Luxembourg, Netherlands, Norway, Poland, Slovenia, United Kingdom. Most respondents returned both questionnaires. The questionnaire's evaluation is described in the following.

In the short questionnaire, for a number of questions a statement was offered asking for (dis-)agreement, where the following scale could be used:

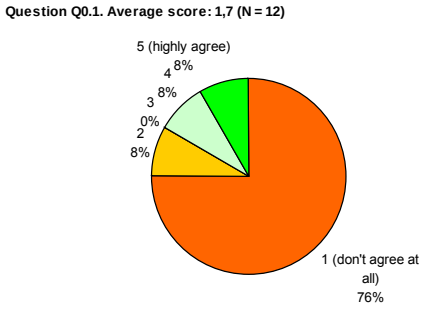
5 = I highly agree
4 = I agree
3 = I generally agree
2 = I hardly agree
1 = I do not agree at all
? = I don't know

4.2 The questionnaire's results

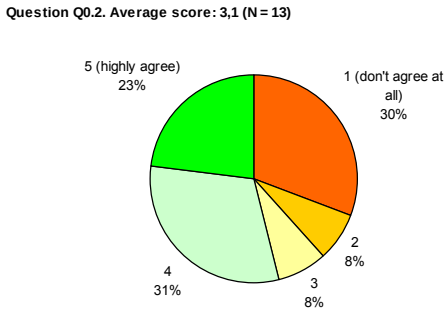
Code: **SQ**: from short questionnaire; **DQ**: from detailed questionnaire

4.2.1 Background situation (personal and national)

SQ 0.1 I am not so closely involved in the methodologies used or prepared for the national building regulations, so my response is my personal impression



SQ 0.2 My response is mainly based on my professional experience



SQ 0.3 My response is based on experience as writer of national standards or codes

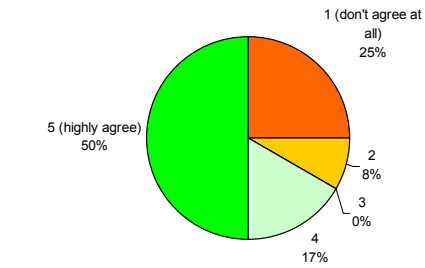


Fig. 4 — Responses on questions concerning personal background

Legend		
Rating	**Description**	**Colour**
5	I highly agree	Green
4	I agree	Blue
3	I generally agree	Yellow
2	I hardly agree	Gold
1	I do not agree at all	Red

SQ 0.4 The field of expertise/professional interest of the respondents is:

Table 1 — Answers to the questionnaire's question SQ 0.4

building physics, building systems, calculation and simulation methods	1
Building Simulation, cooling, overall energy consumption	1
Energy expert	1
Buildings, Energy, Indoor Climate	1
building services, especially ventilation of buildings	1
calculation methods	1
Building Physics	1
Heating systems in buildings	1
Energy in Buildings / HVAC Systems	1
Building Physics	1
Energy use in buildings	1
efficient use of energy	
Thermal and energy properties of buildings	

SQ 0.5 The response refers to a specific sector (residential or non-resid. buildings; new or existing buildings):

Table 2 — Answers to the questionnaire's question SQ 0.5

all buildings	11
mainly new buildings - both residential and non-residential …….	1
residential buildings	1
No answer given	0

SQ 0 Comments:

No important comments

DQ 1 Are you actively involved in

Table 3 —Answers to the questionnaire's question DQ 1

EPBD related national standards	8
National building regulations	7

DQ 1.a Your profession

Table 4 — Answers to the questionnaire's question DQ 1

Building Designer	0
Energy Consultant	3
Architect	0
Representative of a governmental organization	0
Researcher	7
Other	1 (national standardization body)

DQ 1.b How much are you involved in building design issues in your daily work?

Table 5 — Answers to the questionnaire's question DQ 1.b

0 %	1
25 %	3
50 %	3
75 %	2
100 %	1

NOTE At hindsight, this question can be interpreted in different ways.

DQ 2 Is the situation that you describe the current situation or the expected situation in the near future?

We are mainly interested in the near future situation/application of the CEN-EPBD standards in the EU Member States.
This question gives you opportunity to indicate that the current situation is not representative for the near future and that you provide an "expert's best guess" on the expected situation in the near future.

Table 6 — Answers to the questionnaire's question DQ 2

The current situation	7
Or: The situation expected in the near future	3

Comments:

Table 7 — Country-specific answers to the questionnaire's question DQ 2 in detail

Italy	Current situation because EN 13790 is already referred by UNI-TS 11300, which acts as a "national annex" (In Italy the law asks for a calculation of the energy performance according to UNI-TS, both for building permit and for energy declaration)
Luxembourg	Near future. The energy efficiency of non-residential buildings will be regulated in Luxemburg by a new law, probably from 2010 on. This law, currently on the status of a proposal, has been considered for the present document
Netherlands	Near future. New national standard NEN 7120 is in preparation
Poland	Polish implementation of Directive is critisized by professionals and resulted in open letter to Prime Minister published in country wide journal. However, the response of responsible Ministry was not satisfactory. Thus, the correction of existing legislation is very likely, but due to the problems with consultancy quite unknown.

Discussion:

Most respondents, as researcher or consultant, have personal experience as writer of national standards or codes related to the implementation of the EPBD, both for residential and non-residential buildings.

Where relevant and possible, the respondents take into account possible changes in the near future, so that the outcome of this analysis, when there is a difference, is more likely to be applicable to the near future than to the current situation that is likely to change at short term.

4.2.2 Policy related and operational issues

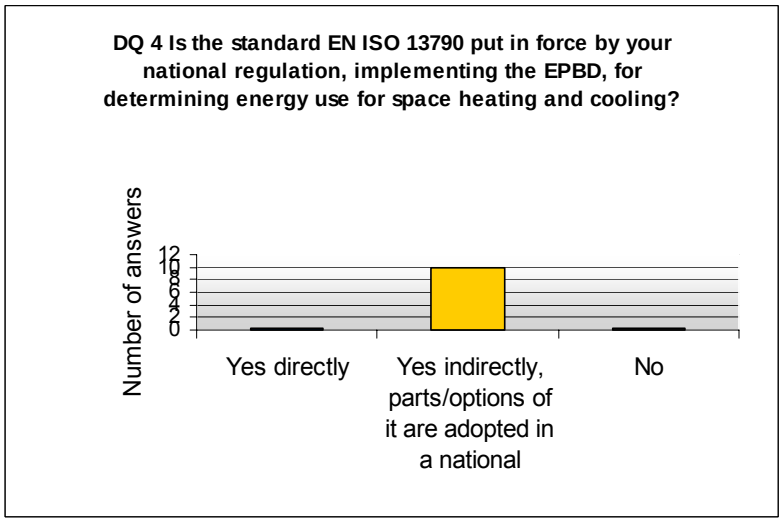


Fig. 5 — Responses on question DQ 4

Discussion: Two of the respondents voted "no", but from the comments it appears that the response should have been "Yes, indirectly".

I) In case of: "Yes, directly":

With a national annex?

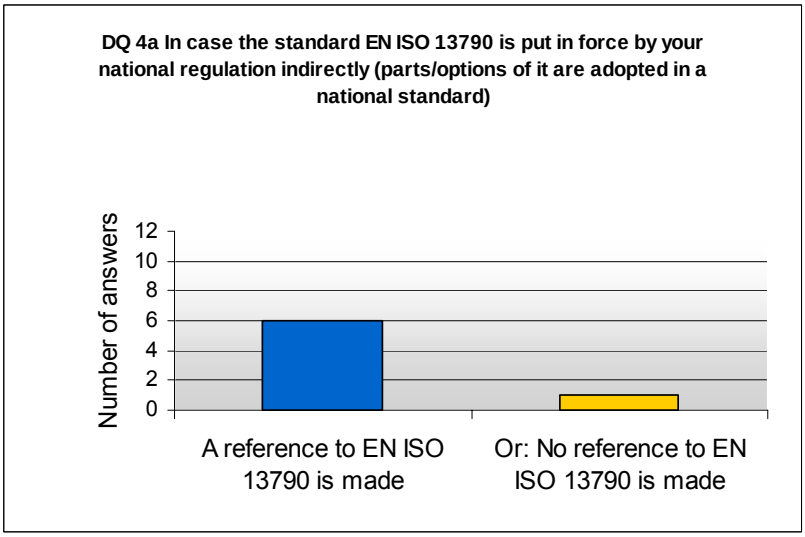
Not applicable, because zero of the responses responded "Yes, directly".

II) In case of: "Yes indirectly, parts/options of it are adopted in a national standard ":

Table 8 — Country-specific answers to the questionnaire's question DQ 4 in detail

	Which parts are implemented?	**In which national Standard?**
Czech Republic	Monthly method for calculation of energy need and energy use for heating and cooling	Decree 148/2007 Coll. describing national calculation methodology
Denmark		
France	All of them, simple hourly method	Th-CE 2005 (new buildings) Th-C-E ex 2008 (existing buildings)
Germany	monthly balanced method	DIN V 18599
Greece		
Italy	Explicit reference is made to the monthly method	UNI-TS 11300-1
Luxembourg		
Netherlands	Monthly method	NEN 7120 (but the basics also in the current national standards NEN 5128 and NEN 2916)
Norway	All parts	NS 3031:2007 Calculation of energy performance of buildings - Method and data
Poland		
Portugal		
Switzerland	Monthly method in SIA 380/1; the simplified hourly method is implemented in a new standard SIA 382/2 valid for buildings with room conditioning systems, i.e. buildings not only heated and ventilated (main target is non-residential)	SIA 380/1; SIA 382/2
UK	All essentials (e.g. we don't include sunspaces at the moment but may be added in future)	SAP and SBEM technical manuals

II) continued:



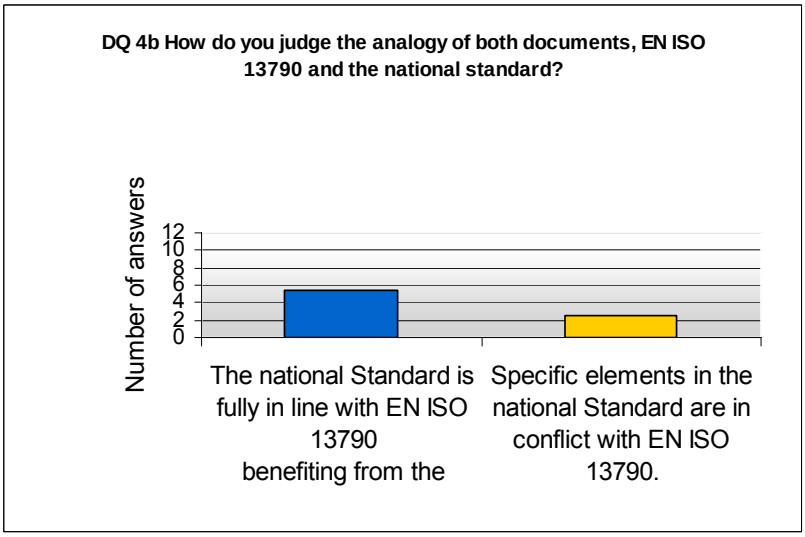


Fig. 6 — Responses on questions DQ 4a-b

II) continued:

In case of: "Specific elements in the national Standard are in conflict with EN ISO 13790":

Which elements?

Table 9 — Country-specific answers to the questionnaire's question DQ 4 in detail (1)

France	As hourly method is used, iterative process for thermal mass is not formally used but heat gains for the sytem are caculated at previous time step
Switzerland	SIA 382/2 is fully in line. SIA 382/2: An addition to the simplified hourly method (SIA 382/2) is made to cover embedded systems calculations
UK	Intermittent heating – doesn't seem right in 13790.

III) In case of "No":

Instead, the following national Standard is implemented,
or the national regulation directly specifies a method for determining energy use for space heating and cooling:

Discussion: Two of the respondents voted "no", but the comments in the table below show that the response should have been "Yes, indirectly".

Table 10 — Country-specific answers to the questionnaire's question DQ 9 in detail (2)

Luxembourg	1) for residential buildings: a own calculation method (monthly methods, similar to 13790 / DIN EN 832) is implemented 2) for non-residential buildings: the Luxemburgish regulation refers to the calculation methods indicated in DIN V 18599
Poland	Polish Standard PN-EN 13790 has been adopted by PKN in June 2008 in English version. In EPBD regulation only the standard translated to Polish can be referrenced. In regulation part of EN 13790 has been translated and adopted (with many mistakes)

Discussion:

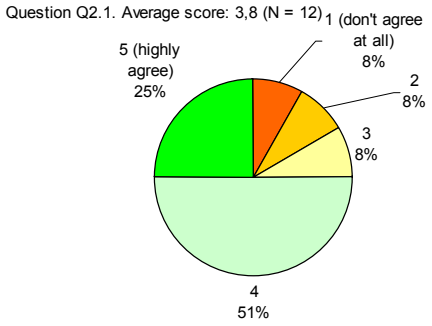
In none of the responding countries EN ISO 13790:2008 is used directly, but in all responding countries indirectly, by copying parts of it in the national standards or building codes.

In most countries there are no or only minor elements conflicting with EN ISO 13790, benefiting from the variety of options that EN ISO 13790 offers. And in most cases a choice is made between monthly, simple hourly or the detailed approach, or multiple choices are allowed.

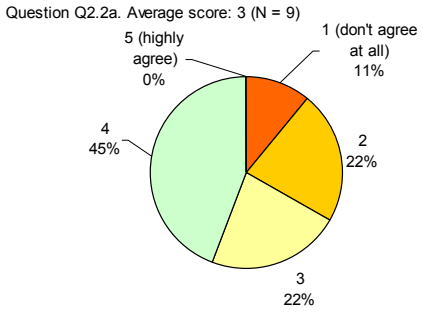
SQ 2 To your opinion, which main <u>operational</u> obstacles need to be removed to implement this specific CEN standard/cluster of CEN standards in the national building regulations?

Scale 5-1 *(5= I highly agree; 1= I do not agree at all; ?= I don't know)*

SQ 2.1 There is no operational obstacle: this specific CEN standard/cluster of CEN standards is or will (in near future) be put in force by our national/regional regulation:



SQ 2.2a 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:



SQ 2.2b ...we would probably implement this specific CEN standard/cluster of CEN standards in the near future in case of a transparent planning of revisions of these CEN standards (when and what) :

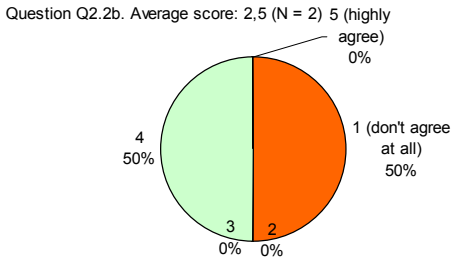


Fig. 7 — Responses on questions SQ 2.1 and SQ 2.2

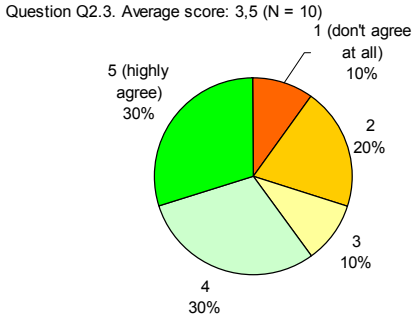
Legend		
Rating	**Description**	**Colour**
5	I highly agree	Green
4	I agree	Blue
3	I generally agree	Yellow
2	I hardly agree	Gold
1	I do not agree at all	Red

Comments:

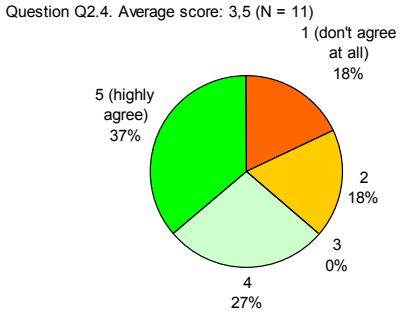
Table 11 — Country-specific answers to the questionnaire's question SQ 2.2 in detail

Austria	Q2.2a: precise response: "the CEN standard has to be ready in time"
Italy	Q2.2b: n.a., already used…

SQ 2.3 A major obstacle is that the timing of the preparation of CEN standards did not coincide with the timing decided at national level (from projectplan to implementation in the law and application in practice) :



SQ 2.4 We need a national method that is compact; consequently we (intend to) integrate selected parts from this specific CEN standard/cluster of CEN standards:



SQ 2.5 A major obstacle is that this specific CEN standard/cluster of CEN standards does not enable us to link the calculation method to national product certification (national product labels or quality marks) :

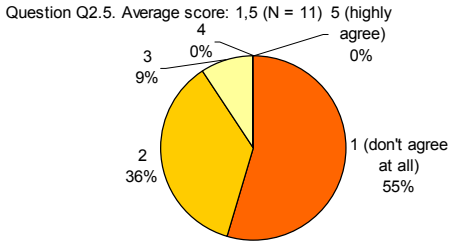


Fig. 8 — Responses on questions SQ 2.3 - SQ 2.5

Legend		
Rating	**Description**	**Colour**
5	I highly agree	Green
4	I agree	Blue
3	I generally agree	Yellow
2	I hardly agree	Gold
1	I do not agree at all	Red

Comments:

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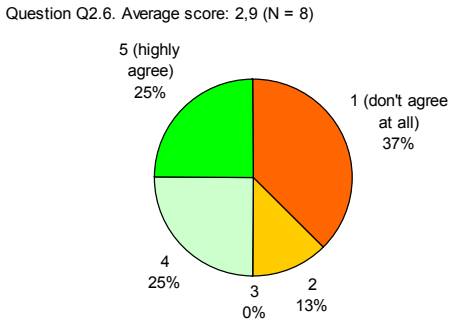
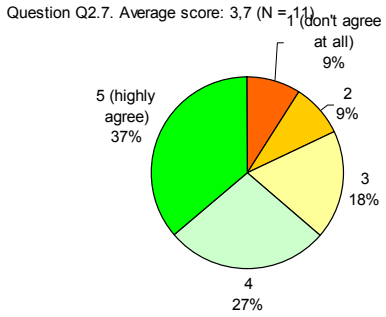
SQ 2.6 This specific CEN standard/cluster of standards is too hard to obtain (price, copy-right protection), compared to our national building regulations:	**SQ 2.7** People involved in our national or regional building regulations should become involved in the CEN standardization activi-ties, otherwise they go their own way:
	

Fig. 9 — Responses on questions SQ 2.6 and SQ 2.7

Comments:

Table 12 — Country-specific answers to the questionnaire's questions SQ 2.6-2.7 in detail

Denmark	EN ISO 13790 is very well. The major problem is some of the other EPBD standards and the interaction of the other EPBD standards with EN ISO 13790.
Finland	the national study mentioned under question 1 will also give some better estimate but some of the issues will need more time and possibly a more thorough study. It will take (more than expected) time and efforts to make the standards better known and to replace the existing national methods and practices
Germany	Q2.7: fortunately they are involved
Italy	Q2.6 n.a.; UNI-TS 11300 specifies how to use EN 13790
Luxembourg	Our national standards are either strongly inspired by DIN Standards (DIN EN 832, DIN 4701) or refer directly to them (DIN V 18599).

Discussion:

Discussion is combined with next question.

Introduction to question DQ 3:

One of the main goals of the IEE-CENSE project is to contribute to an increased use of the CEN standards to support the EPBD in the national and regional building regulations of the EU Member States. To that end, CENSE will prepare recommendations to CEN for improvements in the current set of standards which were published in 2007-2008.
The preferred option for achieving more transparency and harmonisation in the procedures to assess the energy performance of buildings in Europe, is that any CEN standard developed to support the EPBD, is directly referred to in the

- national or regional building regulations, optionally
- after being translated, and optionally
- with a national annex containing the relevant national choices, boundary conditions and input data.

Question:
If this is not the case in your country, for EN ISO 13790:
DQ 3 What would, in your opinion, be the major change(-s) needed in EN ISO 13790, to make the standard applicable in your country, meaning to move to this "preferred option as explained above in the coming years.

Table 13 — Country-specific answers to the questionnaire's question DQ 3 in detail

Czech Republic	EN ISO 13790 was recently published in the Czech Republic as CSN EN ISO 13790:2009 (October 2009). This Standard is the Czech version of the European Standard EN ISO 13790:2008. It was translated by Czech Office for Standards, Metrology and Testing. It has the same status as the official version. This Standard replaces CSN EN ISO 13790:2008 (November 2008) and CSN EN 832:2000 (November 2000).
Denmark	
France	A more direct and applicable link to other standards
Germany	The CEN-standard is referenced in the German standard.
Greece	
Italy	See explanation for Current or Future situation
Luxembourg	The EN ISO 13790 is not directly indicated in Luxemburgish regulation but is indirectly applied by the application of the DIN V 18599 for non residential buildings
Netherlands	See simple questionnaire
Norway	-----
Poland	Part of 13790 is translated into regulation (with many simplification and errors). We are using monthly balance method but no any national values were identified with exemption to climate data.
Portugal	
Switzerland	------
UK	While EN ISO 13790 is published as a British Standard, the regulations do not refer to it directly. Instead there are calculation procedures (known as SAP for dwellings and SBEM for commercial buildings) to which the regulations refer. These calculation procedures use EN ISO 13790 and refer to it. I think this

	amounts to the same thing, so will answer the rest of this on that basis.

Discussion:

There is no operational obstacle to put this specific CEN standard in force by the national/regional regulations.

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. 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.

The timing of the preparation of CEN standards did not coincide with the timing decided at national level (from projectplan to implementation in the law and application in practice)

Many respondents state that they need a national method that is compact; consequently they (intend to) integrate selected parts from this specific CEN standard/cluster of CEN standards.

For a few countries the availability is a problem (maybe because the standard is voluminous, which influences it's price). One country mentions that the interaction of some other standards with EN ISO 13790 is a major problem: A need for a more direct and applicable link to other standards.

SQ 3 Which major steps are needed to implement this specific CEN standard/cluster of CEN standards in the building regulations

- If in your country the CEN-standard is not implemented directly but its methods and equations are put in a national or regional regulation or in a national standard that differs from the CEN standard(s):

Why do you think that is the case?

Table 14 — Country-specific answers to the questionnaire's question SQ 3 in detail (1)

Austria	by writing a new document (method+national regulations) it is easier to check if it is consistent/ complete and usable
Switzerland	There has been a general decision to make national standards (that do not differ technically from the CEN standards) mainly due to quality reasons. This may or may not be adequate for the standard in question here (I think rather not)
Czech Republic	There are references to CEN standards in the national calculation methodology
Finland	many reasons: timing of the CEN/EPBD work was far from optimal, the extent of the EPBD standards is much more than the existing codes . Standards dealing with technical systems need many national explanations (e.g. only part of the ventilation techniques referred to are relevant for Finland) - etc. etc
France	The delay for producing standards is not in accordance with the national rules/regulation production. Some improvement/addition are asked at national level which makes it difficult to use directly the standards, even if it is quite completely reused. Another point is the link with other standards which is not directly operational. National level asked for a complete calculation method with clear connections between the different parts.
Germany	The national standard DIN V 18599 implements one of the options given in the CEN-standard, in the form of an "integrated national application document", which includes the methodology and the national choices and boundary conditions in a continuous document. This makes the German standard directly applicable in daily use. Also some additional aspects missing in the CEN-standards are covered, like for instance Double Skin Façade.
Italy	--
Luxembourg	--
The Netherlands	See above: we need a compact national method
Norway	For simplifications and monthly calculation method (for dwellings and simple smaller buildings) we have used parts and extracts from EN ISO 13790 in a national standard but there is also an option to use EN ISO 13790 directly with national input values when more detailed simulations are required (dynamic calculations).
United Kingdom	

And what needs to be done to make it possible to implement the standard itself?

Table 15 — Country-specific answers to the questionnaire's question SQ 3 in detail (2)

Austria	for each calculation method a separate consistent chapter – then the national standard can refer to chapter X (X= monthly method / one zone or monthly method /coupled multizone or hourly simpilfied/coupled multizone,....)
Switzerland	Hardly possible; actually the national standard is something like the above mentioned "guidance document" which also contains the calculation procedure (in line with the CEN standard); Input and procedure are in the same document.
Czech Republic	"??"
Finland	the main issue will be to convince both the legislators and stakeholders about the benefits of European standards/methods to justify the change (from national way to European, and in the long run into one global methodology). Standards also have to become better known, this also means that many standards (including 13790) have to be translated into national language(s) - and in this work the key issue is to build up a clear and understandable terminology. All this takes much more time than expected !
France	The connection with other astandards should be made operational, as room for improvement/addition at national level
Germany	As mentioned above, the German standard DIN V 18599 is an implementation of the CEN standard.
Italy	Already used: UNI-TS 11300 specifies how to use EN 13790.
Luxembourg	
The Netherlands	restructuring the CEN standard into a common part with clear list of choices to be made at national level and clearly separated from national input data would certainly help
Norway	is already implemented as a normative reference to the national standard for calculation of energy performance of buildings (NS 3031:2007).
United Kingdom	

Discussion:

The responses on these questions (SQ 3) confirm the responses on the previous questions (SQ 2, DQ 3): 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. Consequently, a new structure with clear separation between common parts, national choices and input data would therefore be very helpful. The connection with other astandards requires attention.

Another conclusion: it simply takes time…. (But of course, conditions need to be created to accelerate the process).

4.2.3 General and specific technical and content based issues

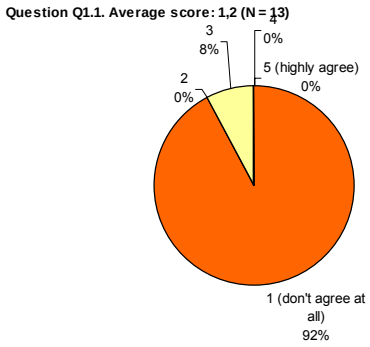
The simple questionnaire part SQ 1 and detailed questionnaire part DQ 5b-c partly overlap. The responses are presented below and analyzed together.

SQ 1 Which major changes in the content of this specific CEN standard/cluster of CEN standards are required to make it/them applicable for the national building regulations.

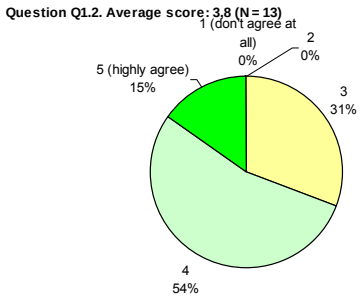
Scale 5-1 *(5= I highly agree; 1= I do not agree at all; ?= I don't know)*

Concerning this specific CEN standard/cluster of CEN standards:

SQ 1.1 Our national building regulations do not ask for the kind of procedures as laid down in this specific standard/cluster of standards and consequently it is not relevant for us:



SQ 1.2 Its structure is clear and understandable:



SQ 1.3 It contains many choices to be made or to be worked out with more detail at national level:

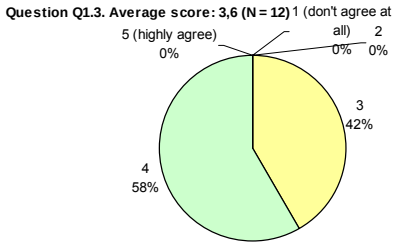
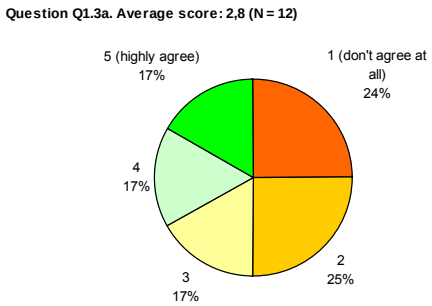


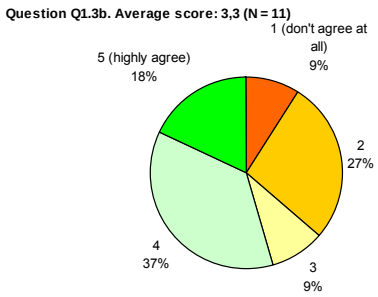
Fig. 10 — Responses on questions SQ 1.1 - SQ 1.3

Legend		
Rating	**Description**	**Colour**
5	I highly agree	Green
4	I agree	Blue
3	I generally agree	Yellow
2	I hardly agree	Gold
1	I do not agree at all	Red

SQ 1.3a A national annex or national "guidance document" describing how this CEN standard must be used to meet the national or regional building regulations is not feasible because too many options, boundary conditions and input data have to be specified:



SQ 1.3b A systematic split between the (harmonized) method and the (national/regional) input data would make it easier to write a national annex or national guidance document:



SQ 1.4 It requires more background information or guidance to be able to use it:

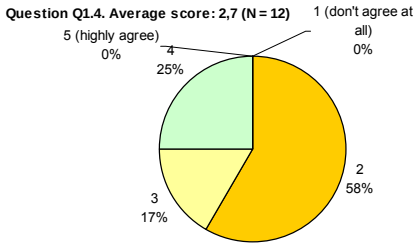


Fig. 11 — Responses on questions SQ 1.3 and SQ 1.4

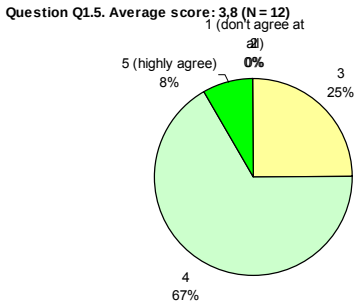
Legend		
Rating	**Description**	**Colour**
5	I highly agree	Green
4	I agree	Blue
3	I generally agree	Yellow
2	I hardly agree	Gold
1	I do not agree at all	Red

Comments:

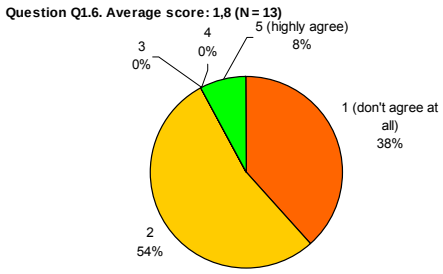
Table 16 — Country-specific answers to the questionnaire's questions SQ 1.3 and SQ 1.4 in detail

United Kingdom	Q.3a: it is the function of the national document to supply these items

SQ 1.5 It covers all relevant issues:



SQ 1.6 It needs to contain a more concrete method:



SQ 1.7 It needs to provide more normative options to choose:

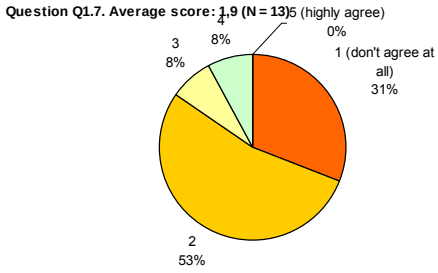


Fig. 12 — Responses on questions SQ 1.5 - SQ 1.7

Legend		
Rating	**Description**	**Colour**
5	I highly agree	Green
4	I agree	Blue
3	I generally agree	Yellow
2	I hardly agree	Gold
1	I do not agree at all	Red

Comments:

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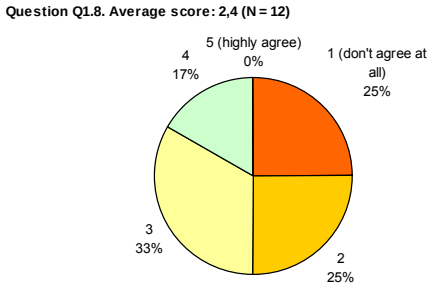
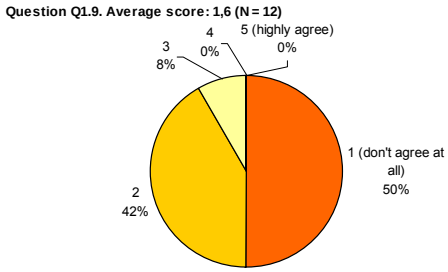
SQ 1.8 It needs to provide fewer options to choose:



SQ 1.9 It needs to be more detailed:



SQ 1.10 It needs to be less detailed:

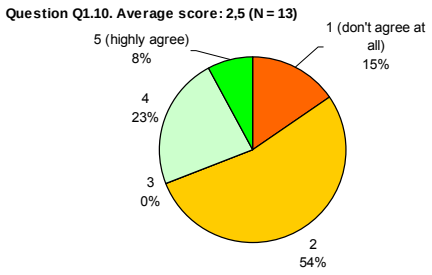


Fig. 13 — Responses on questions SQ 1.8 - SQ 1.10

Legend		
Rating	**Description**	**Colour**
5	I highly agree	Green
4	I agree	Blue
3	I generally agree	Yellow
2	I hardly agree	Gold
1	I do not agree at all	Red

Comments:

Table 17 — Country-specific answers to the questionnaire's questions SQ 1.8 - SQ 1.9 in detail

United Kingdom	Q1.8: we use several of the options, withdrawing them would cause us problems

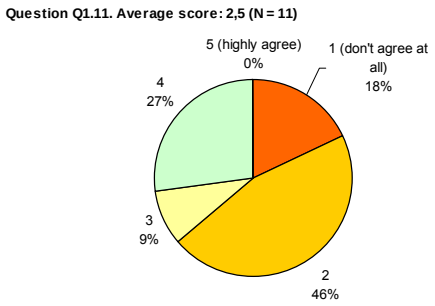
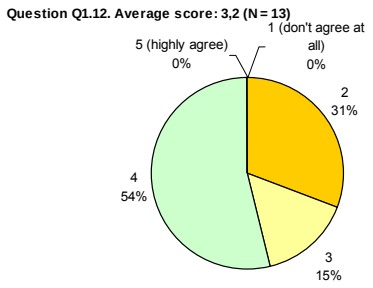
SQ 1.11 It needs to be made more unambiguous:	**SQ 1.12** It needs no major changes:
	

Fig. 14 — Responses on questions SQ 1.11 and SQ 1.12

Comments:

Table 18 — Country-specific answers to the questionnaire's questions SQ 1.11 and SQ 1.12 in detail

Austria	More literature references on the background of the methods. Benchmark examples with detailed documentation
Denmark	As example 3 different methods (time step) and a number of small variations are described in EN ISO 13790 - But we only need one specific method at national level. To refer directly to the standard in the Building Regulation will be a barrier to the implementation of the EPBD in practice. The best is to leave EN ISO 13790 as it is in general (might be smaller corrections) and leave it to the Member States how to best implement it in the country. EN ISO 13790 and the other EPBD standards are since 2006 implemented in the Danish Building Regulations and the Danish energy calculation method
Finland	a national study is just about to start - so especially the "?" (editor ==> "0") marked items will be better answered within the next few months, those already numbered are less likely to change
Germany	Missing:- An explanation clearly describing zoning - Double Skin Façade - Ventilating at night time
Italy	The use in Italy is the monthly method. No significant problem found. Extra radiation to the sky seems overestimated.
Netherlands	Missing: double envelope facades; Also missing: method to take into account difference in the levelling of internal temperature (simple solution developed in NL's new draft of NEN 7120). To be added: for the option of detailed simulation tools: add a list of all (?! at least as many as can be figured...) the details that have to be decided on such method if reproducibility is an important issue. To be discussed: is the procedure to calculate intermittency with the monthly method clear and complete? (But it should remain as simple as it is now). To be discussed: Monthly method and (e.g.) nighttime free ventilation cooling: Isn't it true that the prime advantage of the monthly method is it's transparency and simplicity, at the expense of a certain noise level (in the derivation of correlation coefficients, in casu the gain and loss utilization factor curves). Given this situation: does it make sense to introduce correction factors, such as for lower night temperatures than 24 hr average? If such correction factors are introduced, a pandora box is open to introduce a whole list of correction factors, which is completely against the whole idea of

	the method
Norway	The informative annexes should be separated in two categories, those which should be a part of the national adopted standard (explanatory and with global relevance) and those annexes which could be optional to keep, could be omitted or replaced by national annex with national values, e.g. Annex G in EN ISO 13790. With the current rules for standardization, national standardization institutes are obliged to include all informative annexes even if they are of no relevance for national conditions. This makes the standards unnecessary thick, over-complex and sometimes less relevant for the user.

DQ 5a Do you think the standard is structured and edited appropriately?

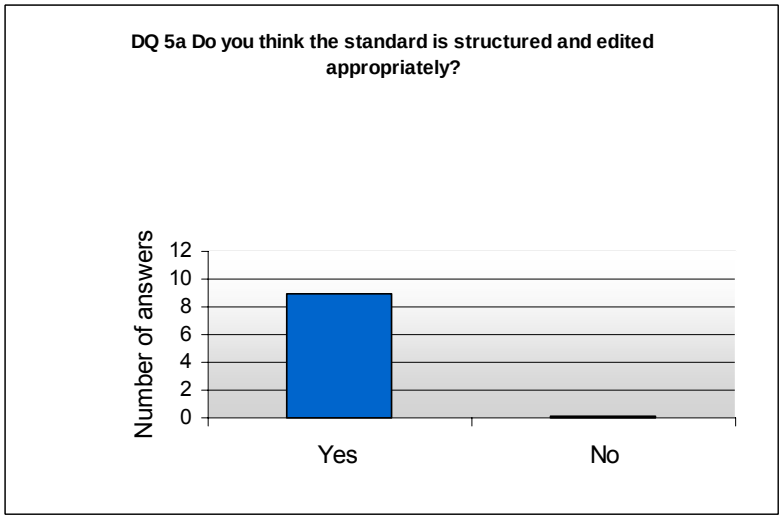


Fig. 15 — Responses on question DQ 5a

In case of no, please specify potential improvements:

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DQ 5b Do you think all relevant parameters, concerning the following specific issues, are addressed in the method?

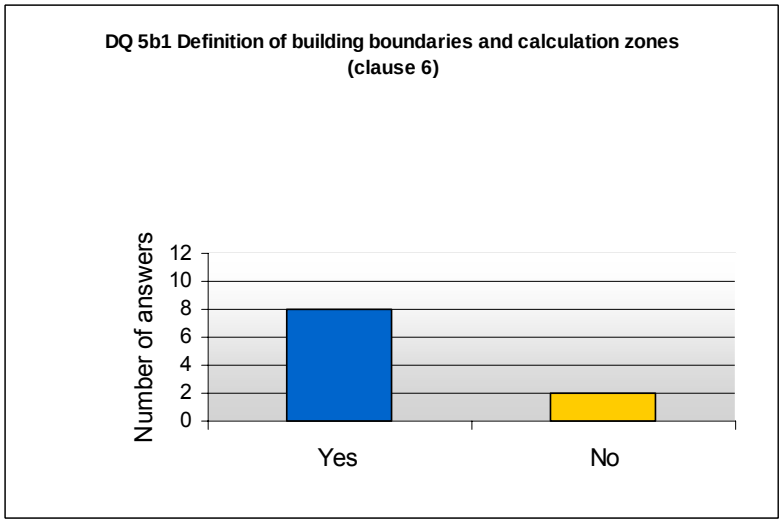


Fig. 16 — Responses on question DQ 5b1

In case of no, please specify potential improvements:

Table 19 — Country-specific answers to the questionnaire's question DQ 5b1 in detail

Germany	The standard focuses on explanations concerning the calculation and its criteria. A separate abstract describing criteria for dividing the building into zones would be helpful
Italy	NOTE: By adding a comment even if I answered YES, I mean that "we can live with it". Of course some improvement is always possible and welcome Additional reasons for zoning: zones according to apartments or building units, zones according to heating system circuits typologies (each one may have different emission and control and distribution characteristics)
Luxembourg	criteria for partitioning in zones

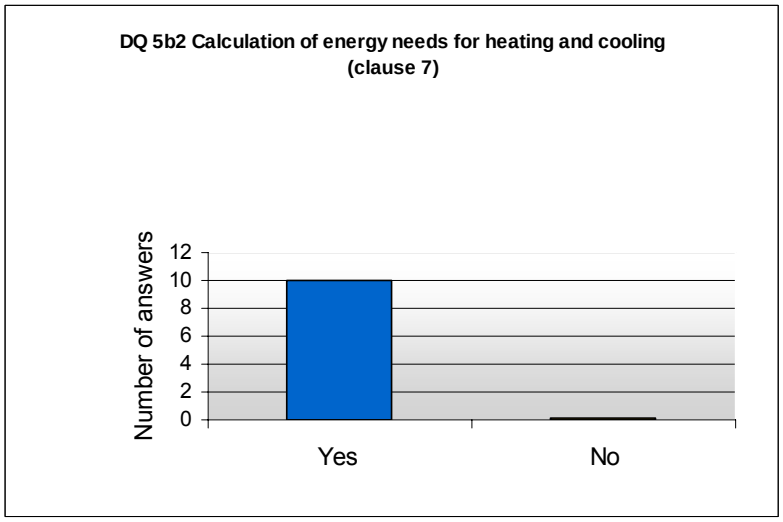


Fig. 17 — Responses on question DQ 5b2

In case of no, please specify potential improvements:

Table 20 — Country-specific answers to the questionnaire's question DQ 5b2 in detail

Netherlands	Only minor improvements See simple questionnaire

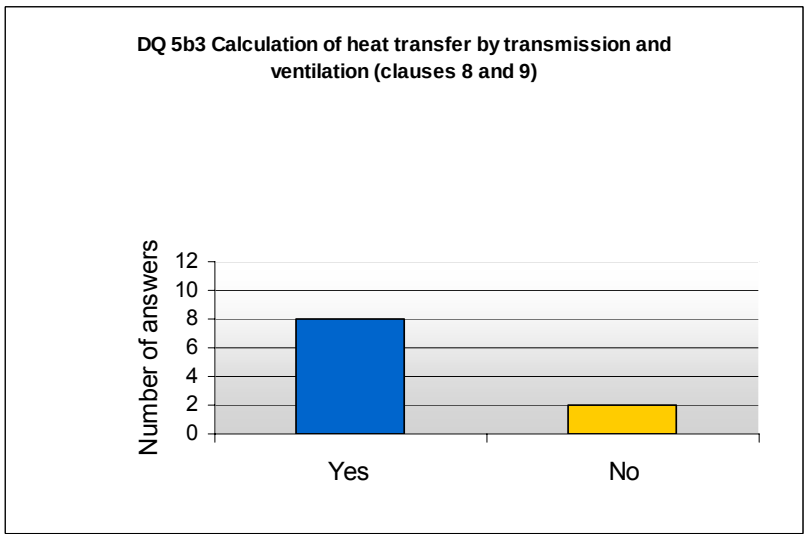


Fig. 18 — Responses on question DQ 5b3

In case of no, please specify potential improvements:

Table 21 — Country-specific answers to the questionnaire's question DQ 5b31 in detail

France	use of windows openings, and mechanical ventilation systems for reducing cooling needs
Luxembourg	Calculation of air flow rates in case of natural ventilation (day time / night time)
Netherlands	Only minor improvements See simple questionnaire (night ventilation for free cooling)

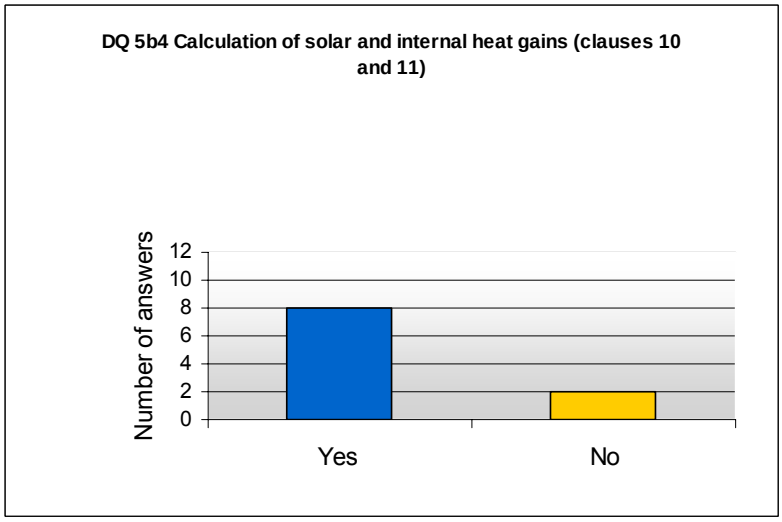


Fig. 19 — Responses on question DQ 5b4

In case of no, please specify potential improvements:

Table 22 — Country-specific answers to the questionnaire's question DQ 5b4 in detail

France	calculation of lighting appliances; automation of solar protection
Italy	NOTE: By adding a comment even if I answered YES, I mean that "we can live with it". Of course some improvement is always possible and welcome Extra radiation to the sky looks overestimated. A vertical wall does not see only "half sky" (as Fr = 0,5 means) but also the ground and other buildings, which may be at a higher temperature than external air
Netherlands	double envelope facades

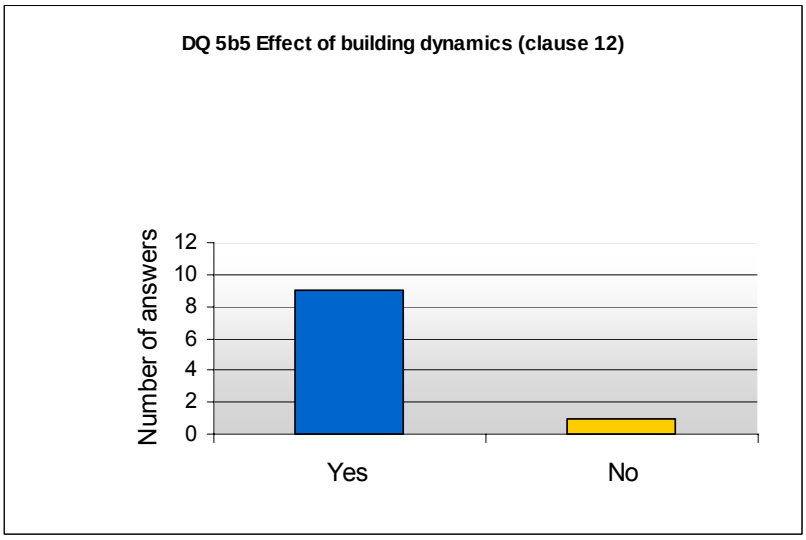


Fig. 20 — Responses on question DQ 5b5

In case of no, please specify potential improvements:

Table 23 — Country-specific answers to the questionnaire's question DQ 5b5 in detail

France	impact of monthly or annual heat capacities (e.g. thickness > 0.10 m)
Netherlands	Only minor improvements See simple questionnaire (intermittency monthly method)

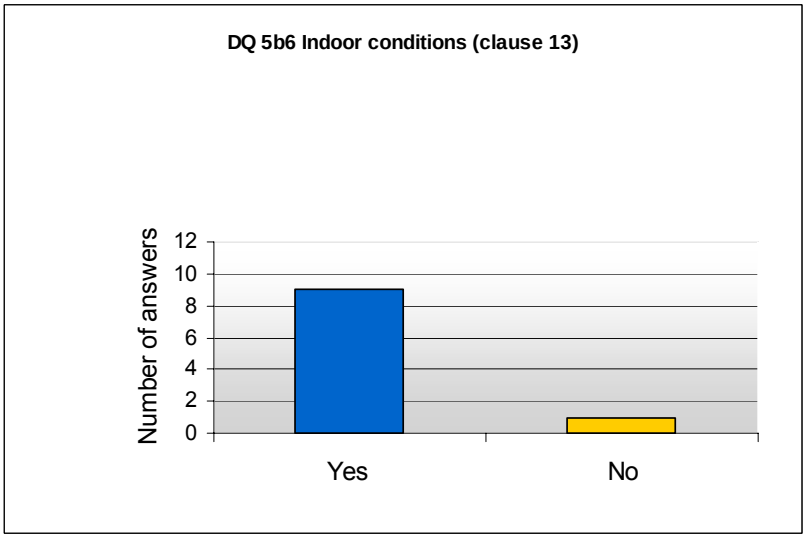


Fig. 21 — Responses on question DQ 5b6

In case of no, please specify potential improvements:

Table 24 — Country-specific answers to the questionnaire's question DQ 5b6 in detail

Netherlands	Only minor improvements See simple questionnaire (spatial levelling temperature)
United Kingdom	Intermittent heating

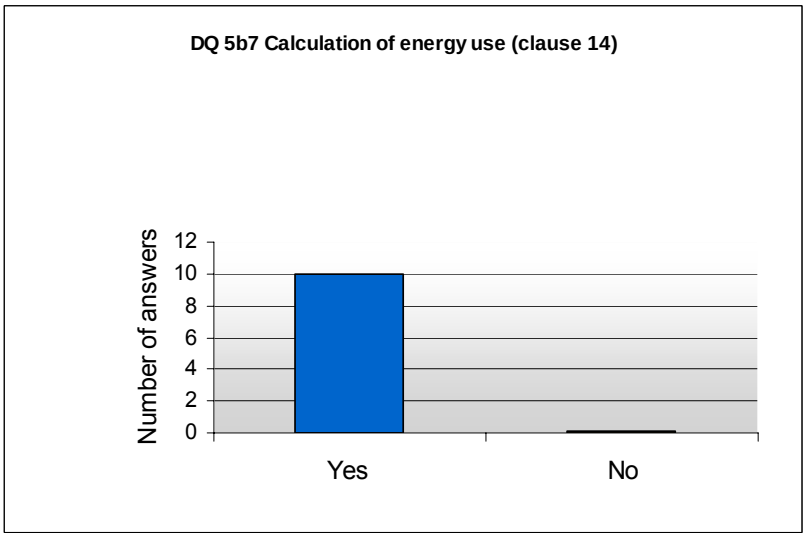


Fig. 22 — Responses on question DQ 5b7

In case of no, please specify potential improvements:

Table 25 — Country-specific answers to the questionnaire's question DQ 5b7 in detail

Italy	NOTE: By adding a comment even if I answered YES, I mean that "we can live with it". Of course some improvement is always possible and welcome EN 15613 should be mentioned, too

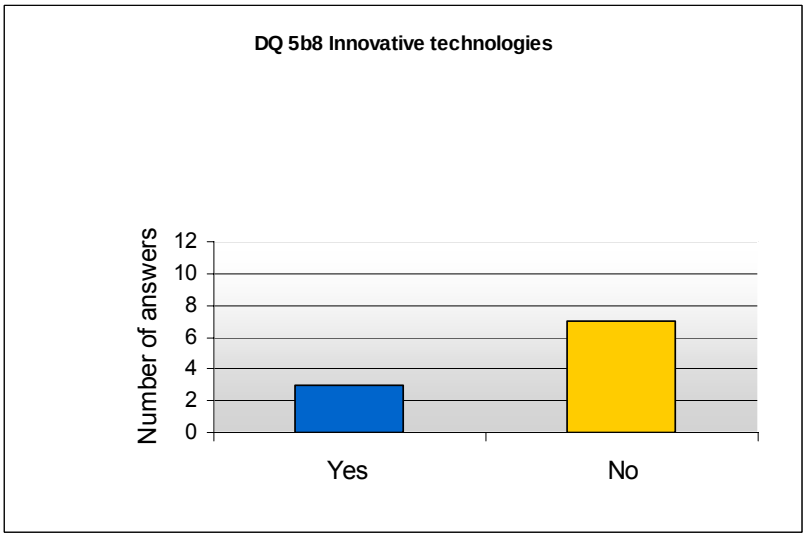


Fig. 23 — Responses on question DQ 5b8

In case of no, please specify potential improvements:

Table 26 — Country-specific answers to the questionnaire's question DQ 5b8 in detail

Czech Republic	Not included in the Czech translation of EN ISO 13790:2009
Denmark	
France	controlled systems based on outdoor or indoor climate (solar shading, ventilation)
Germany	Double Skin Façade; Ventilating at night time
Greece	
Italy	Ventilation at night time, moveable shadings, …
Luxembourg	double skin facades, night ventilation , thermal actication of slabs
Netherlands	double envelope or interactive façade
Norway	
Poland	double facades, night cooling by ventilation, adaptation to variable use, preparation of air in AHU (humidification and dehumidification), possibility to include PCMs.
Portugal	
Switzerland	Embedded systems (An additional node in the simplified hourly calculation)
UK	It is not easy for standards to deal with innovative technologies because of the time needed to prepare standards and the uncertain factors surrounding innovative technologies. Standards should address what is established and (reasonably) well known.

DQ 5b9 Any other :

Please specify potential improvements:

Table 27 — Country-specific answers to the questionnaire's question DQ 5b9 in detail

Netherlands	See simple questionnaire (list of details to be decided for detailed simulation tools)
Norway	The validation of the monthly method in EN ISO 13790 using EN 15265 fails. Even though EN 15265 is restricted to the calculations done with a time step of one hour or less it should be possible to validate this procedure in EN ISO 13790. The main reason for that monthly stationary method fails is that EN ISO 13790 is unable to model cases in en EN 15265 with "aggressive" set-back of internal temperature.

Discussion:

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

All respondents declare the structure of the standard clear and understandable.

On the other hand they state that the standard contains many choices to be made or to be worked out with more detail at national level.

The next question is whether there are too many options, boundary conditions and input data to be specified at national or regional level to make a national annex or national "guidance document" (describing how this CEN standard must be used to meet the national or regional building regulations) feasible? It is interesting to see that on this question the opinions are equally divided over the choices from "highly agree" to "I do not agree at all". In the analysis of the responses one should take into account that no country adopted this option up until now (despite the fact that this is "normally" the only option acceptable within the CEN rules!), so the "don't agree at all" may be based on an underestimation of the effort it would take.

Nevertheless, a majority believes that a systematic split between the (harmonized) method and the (national/regional) input data would make it easier to write a national annex or national guidance document.

About restructuring standard/informative annexes/national annex one respondent states: With the current rules for standardization, national standardization institutes are obliged to include all informative annexes even if they are of no relevance for national conditions. This makes the standards unnecessary thick, over-complex and sometimes less relevant for the user.

According to the respondents, other possible operational obstacles are not relevant for this standard:

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 it needs to provide fewer options to choose: withdrawing them would cause problems to specific countries where several of the options are used.

A minority of the respondents state that the standard needs to be made more unambiguous and needs major changes. Mentioned subjects for improvement are listed below per subject.

See individual responses for details.

Definition of boundary conditions and calculation zones (clause 6):

— To add: more explanation on partitioning the building into calculation zones

Calculation of energy needs for heating and cooling (clause 7):

— To check: intermittency: see below

Calculation of heat transfer by transmission and ventilation (clauses 8 and 9):

— To add: extra (day or night) natural or mechanical ventilation for cooling

— Preparation of air in AHU (humidification and dehumidification)

Calculation of solar and internal heat gains (clauses 10 and 11):

— To add: calculation of lighting appliances

— To add: solar shading controlled on outdoor or indoor climate

— To check: extra radiation to the sky seems overestimated (sky vs other buildings)

Effect of building dynamics (clause 12):

— To check: impact of monthly or annual heat capacities (e.g; thickness > 0.10 m)

Indoor conditions (clause 13):

— To check: intermittency correction factors for the monthly method (and link with validation according to EN 15265)

— To add: effect of spatial levelling of internal temperature in dwellings (because normally only part is heated/cooled; simple method from NEN 7120, as function of specific heat losses).

Calculation of energy use (clause 14):

— Links to EN 15613

On innovative technologies:

— To add: double envelope or interactive façades

— To add: night cooling by ventilation, based on outdoor or indoor climate

— To add: possibility to include PCMs (phase change materials).

— To add: embedded systems (An additional node in the simplified hourly calculation)

Any other:

— To add: the sense or nonsense of (too) many correction factors in a simplified monthly method

— To add: list of details that that need to be harmonized to ensure reproducibility for detailed methods

— To add: more literature references on the background of the methods

— To add: benchmark examples with detailed documentation

4.2.4 Options chosen at national or regional level

DQ 5c EN ISO 13790 provides different options. Which option to use is to be decided at national level. The following questions aim to get information about these choices in your country:

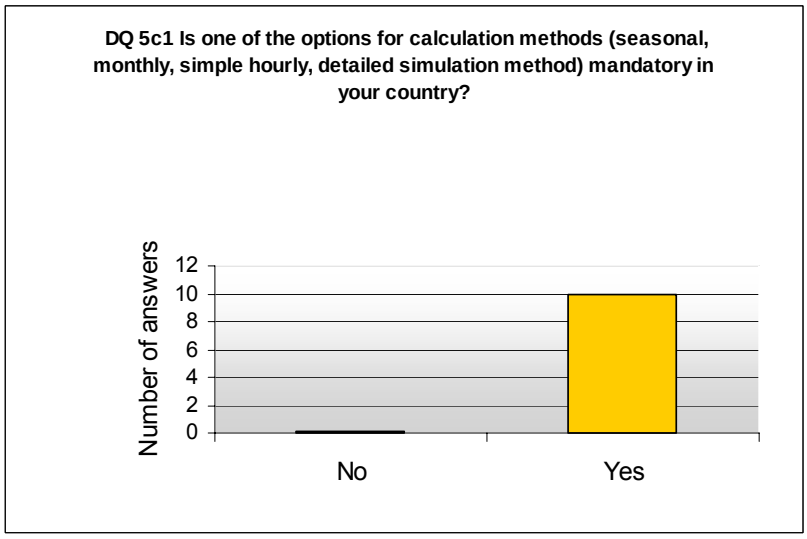


Fig. 24 — Responses on question DQ 5c1

DQ 5c1 continued In case of "Yes":

Please specify which option and for which application(s) (e.g. for residential, small commercial, or large commercial buildings)

Table 28 — Country-specific answers to the questionnaire's question DQ 5c1 in detail

Czech Republic	Monthly or simple hourly (for buildings with low thermal inertia) calculation method is required and mandatory for all types of buildings.
Denmark	
France	simple hourly for all buildings
Germany	the monthly calculation method, for all applications
Greece	
Italy	Monthly method for all buildings. NOTE: dynamic calculation may also be used but de facto only the monthly method is used. Cooling calculation requirements are limited to energy need with the monthly method, excluding latent heat.
Luxembourg	for residential buildings: monthly for non residential buildings: reference to DIN V 18599 (→ monthly)
Netherlands	monthly, for all types
Norway	The national standard (NS 3031) is refering to EN ISO 13790 and includes three options for calculating the heating and cooling needs:

	- Monthly calculation (stationary method) according to EN ISO 13790; - Simplified hourly calculation method (dynamic method) according to EN ISO 13790; - Detailed validated computational calculation (dynamic method) according to EN 15265. Selection of appropriate method of calculation is based on criteria such as reproducibility in the calculation, accuracy, appropriate level of detail and access to input data for the calculation. The choice of method of calculation will typically depend on how the current building is intended to be used (categories of different building types, e.g. dwellings or commercial buildings), the complexity of building and installations, if the building is new or existing and the purpose of energy calculation (design or certification). For simple buildings without cooling and with normal glass area the monthly stationary calculation method should give results with acceptable level of accuracy. Simple buildings are buildings with a small degree of dynamic influences on the heat and cooling loads. For complex buildings with climate control systems for installations, large glass areas in the building envelope with a corresponding large solar gain, or buildings with large and varying internal heat contributions, it would be appropriate to use a dynamic method of calculation.
Poland	Monthly balance for all types of buildings
Portugal	
Switzerland	Monthly (heated and ventilated only buildings) – simplified hourly (buildings not only heated and ventilated)
UK	Residential is seasonal at the moment but we are thinking of changing to monthly (better for very low energy buildings). Commercial is monthly with a detailed simulation option.

Summary:

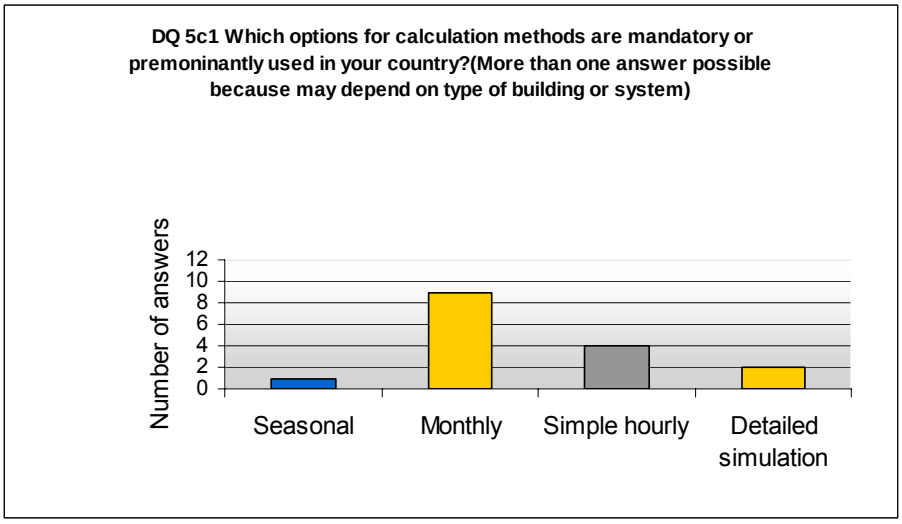


Fig. 25 — Responses on question DQ 5c1 (continued)

DQ 5c2 Is, in your country, the effect of thermal losses from heating and cooling systems on the energy needs for heating and cooling calculated iteratively or in a single step?

Table 29 — Country-specific answers to the questionnaire's question DQ 5c2 in detail

Czech Republic	Single step – distribution losses.
Denmark	
France	Not directly but through losses calculated at the previous hour
Germany	The termination condition is either a remaining difference smaller than 0,01% of the value or max. 10 iteration steps
Greece	
Italy	
Luxembourg	for residential buildings: single step (tabled values) for non residential buildings: reference to DIN V 18599
Netherlands	No iteration, single step
Norway	No iteration, single step
Poland	No iteration, single step
Portugal	
Switzerland	Losses in conditioned space are not considered, assuming they are recoverable and fully recovered – so the answer could also be "no". Losses in unconditioned space are considered.
UK	No iteration, single step

Summary:

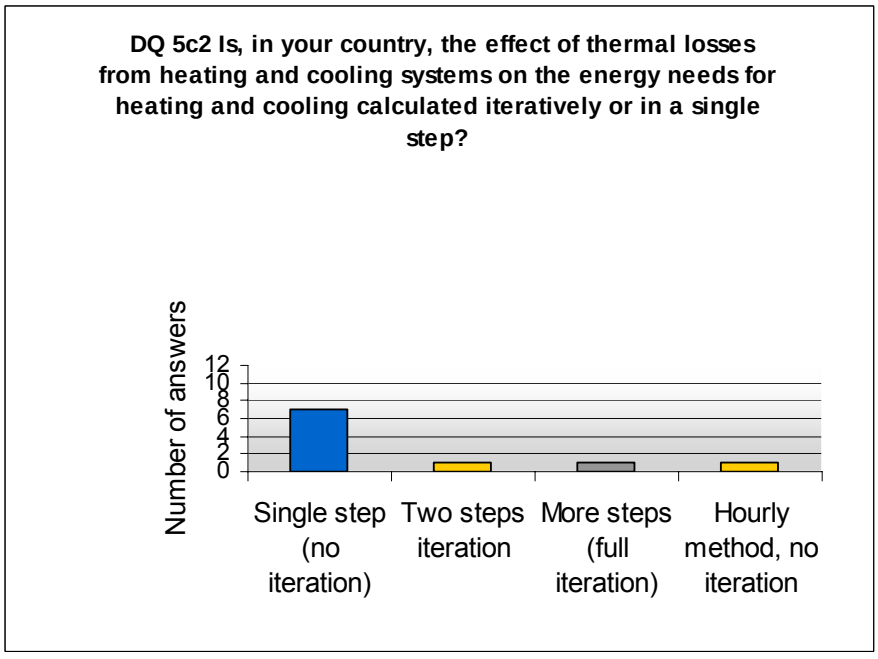


Fig. 26 — Responses on question DQ 5c2

Discussion:

The different options for calculation methods (seasonal, monthly, simple hourly and detailed simulation method) are all used in one or more countries, sometimes depending on the type of building or system, sometimes more than one option is allowed for a given situation.

In case of a monthly method the recoverable energy losses by the technical building systems for heating and cooling may affect the energy needs, which already have been calculated in order to calculate the system losses. This can be solved by iteration or by a simplified approximation (no iteration) or a first order (two steps) iteration. Only two countries mention a two step or full iteration.

4.2.5 Passive Heating and Cooling

a)

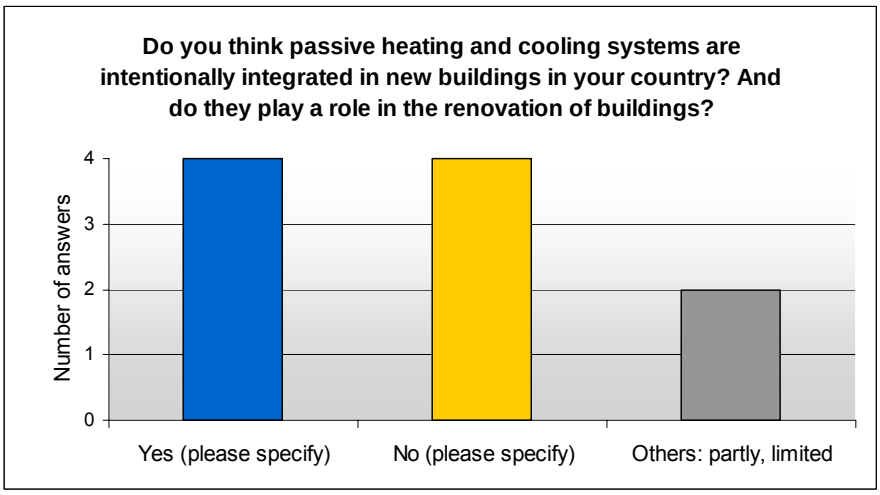


Fig. 27 — Diagram illustrating the responses given to question DQ 6a) of the questionnaire

Discussion:

The opinion about the role of passive systems in new as well as in retrofitted buildings highly differs but is equally balanced between yes and no. 4 out of the 10 answers given indicate, that both, passive heating and passive cooling systems are intentionally integrated in buildings. Especially their high importance in low energy buildings is emphasized. Also national standards calling for appreciating and integrating passive systems and options are mentioned. Contrary, also 4 representatives clearly answer with ‘no’. Nevertheless, partial use of passive heating and cooling systems is noted, for instance, on small scale, in pilot projects or regarding particular aspects. The remaining two answers support the balanced overall opinion, indicating partly or limited consideration but pointing out increasing awareness. In general, passive heating is rated to be acknowledged higher and taken into consideration more often than passive cooling.

Table 30 — Country-specific answers to the questionnaire's question DQ 6a) in detail:

Do you think passive heating and cooling systems are intentionally integrated in new buildings in your country? And do they play a role in the renovation of buildings?	
Czech Republic	No, Passive heating and cooling are not intentionally integrated. Only pilot or experimental new buildings are envisaged to these systems.
Denmark	
France	Yes, passive heating and cooling plays a major role for low energy buildings, both for new and existing buildings
Germany	Yes, Passive heating and cooling is equally important as transmission and ventilation!
Greece	
Italy	No, Only sun spaces are used (… very often the main concern is using the balcony as an extention of the apartment…)
Luxembourg	Passive Heating is partly considered, especially for smaller buildings in Low Energy Standard Passice Cooling is partly considered for office buildings, but not yet used to its full potential.
Netherlands	No, Not at large scale, only small scale
Norway	Yes, In the Norwegian building codes we have the following requirement: "Buildings shall be designed and constructed such that a substantial portion of the heating requirements can be met with other energy wares than electricity or fossil fuels at the end user". This requirement stimulates to the design of passive heating and cooling systems.
Poland	No, Polish regulations require limited passive solutions eg. Limiting are of transparent elements, or limiting g-value for windows
Portugal	
Switzerland	Yes
UK	Passive heating – yes, sometimes; awareness is increasing. Passive cooling – limited."

b)

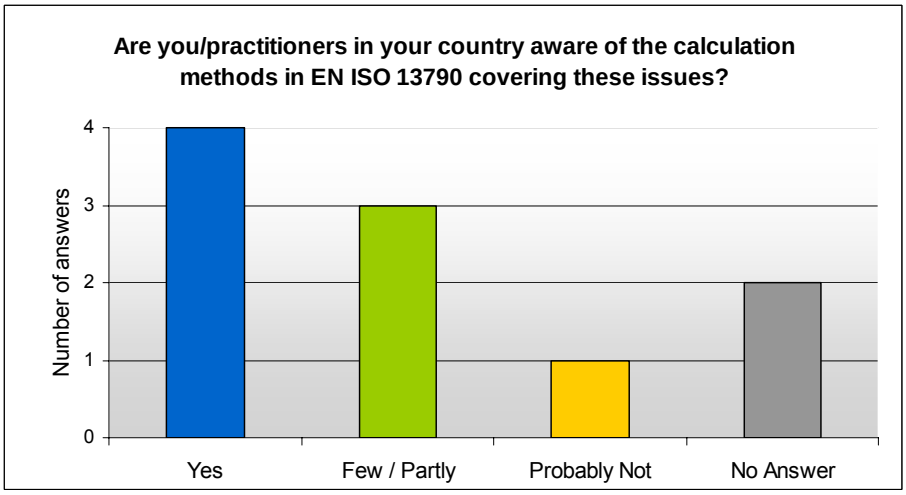


Fig. 28 — Diagram illustrating the responses given to question DQ 6b) of the questionnaire

Discussion:

Taking into account the broad and differing background of the questionnaire's target group, the formulation of question 6b) allows giving either a personal answer, in case of practical experience, or an estimation of the national situation, in case of a theoretical working environment. In consequence the interpretation needs to be looked at with special care. In addition, only 7 out of the 10 answers given can be evaluated, as two are missing and one sounds quite unsure.

As more than half of these remaining replies give a clear yes, and the rest indicates low or partial knowledge, the standard's general awareness can be rated good but with a noticeable potential of improvement. This increasing awareness should not only be aimed at, it is already expected and predicted in connection with planned implementations of standards and regulations.

Table 31 — Country-specific answers to the questionnaire's question DQ 6b) in detail:

Are you / practitioners in your country aware of the calculation methods in EN ISO 13790 covering these issues?	
Czech Republic	Yes
Denmark	
France	Yes
Germany	Yes
Greece	
Italy	If you mean annex E, very few are aware. I never saw a real "Trombe wall".
Luxembourg	Only partly. For the moment, a lot of non-residential objects are still planned with just rough estimations of their future energy consumptions. This situation will change by the nature regulation, which imposes a calculation method referring to DIN V 18599.
Netherlands	Yes, a comparison has recently be made by ECN between the PH-method and the national standard
Norway	I do not know.
Poland	Few researchers are aware.
Portugal	

Switzerland	-
UK	Probably not

c)

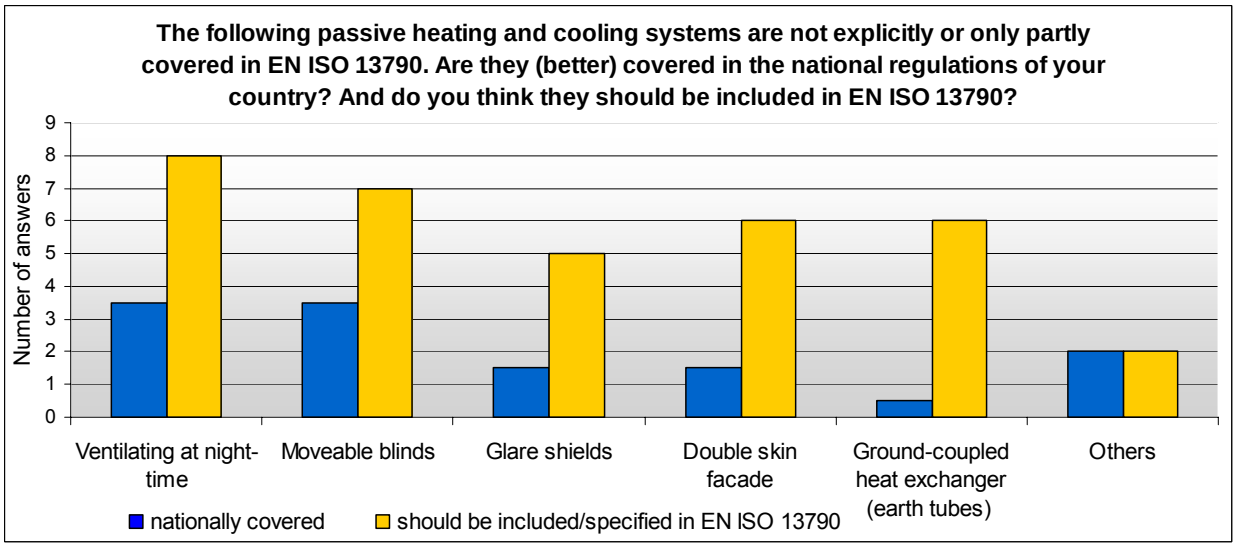


Fig. 29 — Diagram illustrating the responses given to question DQ 6c) of the questionnaire

Discussion:

Regarding passive heating and cooling, in addition to a general evaluation of the standard's content, the questionnaire also aimed at inquiring specific related issues, which supposably need to be covered in detail or in more detail in standardisation.

Parallel to requirements identified in need of changes or extensions within the CEN-standard EN ISO 13790, also their status of coverage in national regulations is asked for. Figure 29 shows, that the inclusion of all the suggested aspects is supported by at least half of the representatives participating, as indicated by the yellow bars ranging between 5 and 8 (out of 10 answers given).

The first two aspects mentioned, 'ventilating at night-time' and 'moveable blinds', which are only covered partly in the current version of the standard, are rated of most importance, with 8 and 7 votes. Regarding their consideration in national documents they are also ranked first, as shown by the large blue bars. Exceptionally, in this rating also half points are awarded, standing for partial implementation. In this particular case, the application is limited to the building type, non-residential or residential buildings.

Interpreting the variance between identified need and current consideration, the issue of 'Ground-coupled heat exchanger' sticks out with a difference of 5,5. This issue is currently only taken care of in one country for residential buildings only.

Two additional issues were identified, each particularly covered in a national regulation and consequently judged of high importance by the respective representative: 'spatial temperature levelling' and 'embedded systems coupled to boreholes'.

Table 32 — Country-specific answers to the questionnaire's question DQ 6c) in detail:

The following passive heating and cooling systems are not explicitly or only partly (ventilating at night-time, moveable blinds) covered in EN ISO 13790. Are they (better) covered in the national regulations of your country? And do you think they should be included in EN ISO 13790?												
Passive systems:	Ventilating at night-time		Moveable blinds		Glare shields		Double skin facade		Ground-coupled heat exchanger (earth tubes)		Others:	
Status / need of coverage:	nationally covered	should be included in EN ISO 13790	nationally covered	should be included in EN ISO 13790	nationally covered	should be included in EN ISO 13790	nationally covered	should be included in EN ISO 13790	nationally covered	should be included in EN ISO 13790	nationally covered	should be included in EN ISO 13790
Czech Republic		x		x		x		x		x		
Denmark												
France	x	x	x	x				x		x		
Germany	x	x	x	x	x	x	x	x		x		
Greece												
Italy		x		x		x						
Luxembourg	non-residential (referring to German standard)		non-residential (referring to German standard)		non-residential (referring to German standard)		non-residential (referring to German standard)		residential			
Netherlands	Comment: In particular this is relevant for PH because the corrected setpoint will be higher than for low insulated houses										spatial temperature levelling	
											x	x
Norway		x		x		x		x		x		
Poland		x		x		x		x		x		
Portugal												
Switzerland	x	x	x	x							embedded systems coupled to boreholes	
											x	x
UK		x						x		x		

d)

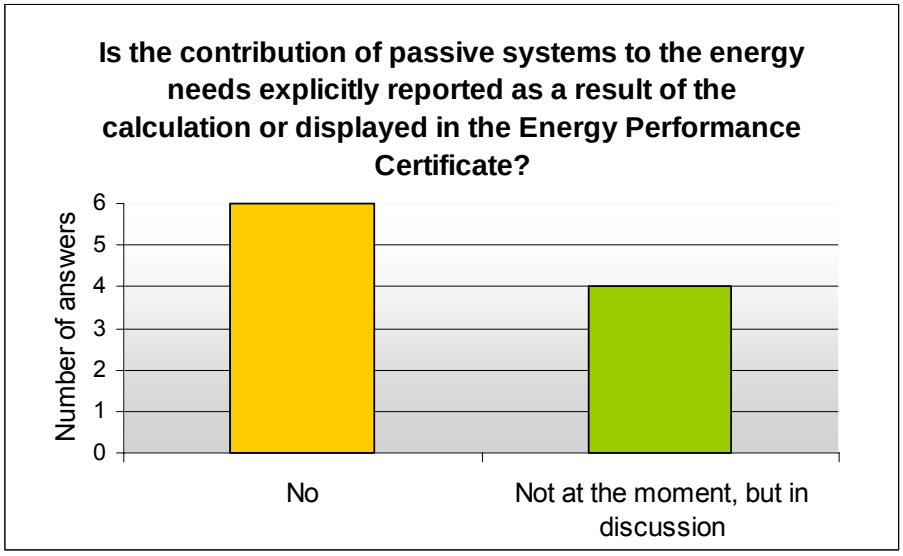


Fig. 30 — Diagram illustrating the responses given to question DQ 6d) of the questionnaire

Discussion:

At the moment in none of the responding European countries, the contribution of passive systems to the energy needs is explicitly reported as a result of the calculation or displayed in the Energy Performance Certificate. But it is a good sign that in 4 out of the 10 answers received, a change thereof in near future is indicated or the discussion of this issue is reported. Additionally the influence CEN could have there is emphasized.

Table 33 — Country-specific answers to the questionnaire's question DQ 6d) in detail:

Is the contribution of passive systems to the energy needs explicitly reported as a result of the calculation or displayed in the Energy Performance Certificate?	
Czech Republic	No
Denmark	
France	Not for the existing regulation, but in discussion for the new one for new buildings
Germany	No, not at the moment, but it is planned to be shown.
Greece	
Italy	NO. Only renewable as contribution through the system.
Luxembourg	No
Netherlands	Not mandatory and the informative procedure is until now not applied by any software as far as I know. Maybe in future, if e.g. CEN would spell out the equations
Norway	No
Poland	No
Portugal	
Switzerland	No
UK	No

4.3 Evaluation of the questionnaire

4.3.1 General

Most respondents, as researcher or consultant, have personal experience as writer of national standards or codes related to the implementation of the EPBD, both for residential and non-residential buildings.

Where relevant and possible, the respondents take into account possible changes in the near future, so that the outcome of this analysis, when there is a difference, is more likely to be applicable to the near future than to the current situation that is likely to change at short term.

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. There are no operational obstacles 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 projectplan to implementation in the law and application in practice). 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. 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.

It is true that it already required 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.

For a few countries the availability is a problem (meaning that each standard has to be bought; some standards are voluminous, which adds to their price).

All respondents declare the structure of the standard clear and understandable. But they state that 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.

Many respondents state that they need a national method that is compact; consequently they (intend to) integrate 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. Consequently, a new structure with clear separation between common parts, national choices and input data would therefore be very helpful.

It appears important to make a systematic split between the (harmonized) method and the (national/regional) input data. This would make it easier to write a national annex and/or national guidance document.

The volume of the informative annexes to the standard makes the standard unnecessary thick, overcomplex 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. Therefore an important recommendation is to move all informative annexes to a separate Technical Report, accompanying the standard.

The different options for calculation methods (seasonal, monthly, simple hourly and detailed simulation method) are all used in one or more countries, sometimes depending on the type of building or system, sometimes more than one option is allowed for a given situation.

In case of a monthly method only 2 out of the 10 countries use a two step or full iteration to calculate the effect of recoverable system losses on the energy needs.

4.3.2 Passive heating and cooling

Chapter 6, the last-one of the detailed questionnaire covers passive heating and cooling. This important issue is currently gaining in importance, due to its required influence in low energy buildings and because of steadily and considerably increasing energy-costs. Regarding the role of intentional use of passive systems in new and retrofitted buildings, the overall opinion differs but is equally balanced. Their significance seems to depend on several aspects, e.g. on the country (climate) and its building codes, on the building size and type and on the level energy performance. In general an increasing awareness is reckognized and passive heating is rated to be acknowledged higher and taken into consideration more often than passive cooling.

The awareness of the calculation methods covering passive issues can be rated good but with a noticeable potential of improvement, as some countries' participants indicate a low awareness focussed on reasearchers. Especially among practitioners a higher awareness and knowledge is required.
In general most passive systems are not explicitly covered in the CEN-standard but influence the calculation methodology on different stages. Especially new technologies, such as double skin facades, but also old-fashioned successful means, such as ventilating at night-time, should be covered explicitly and in detail to increase awareness of passive heating and cooling as well as to support use and applications.

An even better and probably more effective support of awareness and use of passive systems would be 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. This is currently not the case in all European countries, but it is discussed in many, a good sign indicating the right way. CEN could play an important role by recommending possible ways.

4.3.3 Recommendations

This analysis leads to the following recommendations regarding 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 annexees 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.

A number of specific subjects for improvement of or addition to the standard have been mentioned. The main subjects are (see more in the paragraphs above):

— To add: more explanation on partitioning the building into calculation zones.

— To add: extra (day or night) natural or mechanical ventilation for cooling.

— To add: solar shading controlled on outdoor or indoor climate.

— To check: extra radiation to the sky seems overestimated (sky vs other buildings).

— To check: intermittency correction factors for the monthly method (and link with validation according to EN 15265).

— To add: effect of spatial levelling of internal temperature in dwellings (because normally only part is heated/cooled; simple method from NEN 7120, as function of specific heat losses); see Annex A.

— To add: double envelope or interactive façades.

— To add: the sense or nonsense of (too) many correction factors in a simplified monthly method.

— To add: list of details that that need to be harmonized to ensure reproducibility for detailed methods.

— To add: Explicit calculation methods for passive systems, especially for new technologies

— To add: Possible recommendations how to display the influence of passive systems on the energy performance of buildings

From this list it can be concluded that concerning the technical content only specific improvements are needed which do not turn the procedures upside down.

Finally: harmonization simply takes time…. but with a good set of conditions the process can be significantly accelerated.

5 Presentations and Workshops on EN ISO 13790

5.1 Presentations

On several occasions presentations about the CEN-standard EN ISO 13790 were held within the CENSE-project. In most cases as part of the presentation of the set of key CEN standards to support the EPBD. Despite the usually happening discussion normally following each of these presentations, which are additionally often quite short and do not go into much detail, these presentations can clearly be seen as a one-way-information. Nevertheless they are highly important in the context of the CENSE-project, as they are a good opportunity to increase awareness of and knowledge about the CEN-standards.

The content of the presentations included the description of the main features of the standard and its methodology and the preliminary evaluation and results of the questionnaire as well as some additional background information about CEN and CENSE. The high awareness of the standard identified in the questionnaire could also be recognized in the presentations audience.

5.2 Workshops

Different from presentations, which primarily aim at informing about the CENSE-project and the CEN-standards, workshops focus on discussions intending 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 of an intense discussion. In particular it was tried to identify and discuss problems arising from the content of the standard and its implementation.

Due to the personal way of communication an open discussion in more detail was possible, compared to the restricted form of the written questionnaire. Nevertheless, the conclusions derived from all the workshops held on EN ISO 13790 were generally the same as those from the questionnaire, apart from some points, where additional observations and experiences were formulated. Consequently, as the questionnaire's results were confirmed, they can be considered very relevant.

General remark:
The feed back and input provided by country representatives at the workshops was sometimes very detailed and to the point. This shows the great interest in the CEN standards from the people who are involved in the preparation of the national methods in the Member States. Practical and affordable ways should be found to actively involve these kind of persons in the preparation of the second generation of CEN standards for the EPBD

A few of the workshops are highlighted in the following paragraphs.

5.2.1 Workshop at the Concerted Action Meeting, December 1, 2008 in Prague

A joint initiative of the EU Member States and the European Commission, the Concerted Action EPBD was launched in 2005. It involves those representatives of national ministries or their affiliated institutions charged with preparing the technical, legal and administrative framework for the Energy Performance of Buildings Directive, EPBD (2002/91/EC) in each country. The key aim is to enhance the sharing of information and experiences from national adoption and implementation of this important European legislation. This makes the meeting a suitable platform to present and discuss intermediate results of the CENSE-project.

Making use of this good opportunity, a CENSE-workshop took place at the Concerted Action Meeting at December 1, 2008 in Prague, with 44 participants from 28 different European countries, consisting of 12 policy makers and 32 advisers to policy makers. The workshop started with general information about the CENSE-project, its background, aims and first results, before several issues were covered in more detailed, including "the Overall Consistency of the CEN EPBD standards". EN ISO 13790, as one of the key standards for the EPBD, is quite relevant in this section. For all issues, in addition to the speaker of the CENSE-project, country-presentations from different European states were held, introducing experiences made with the implementation of CEN standards and the national or personal evaluation of the specific standards' content. Regarding the Overall Consistency of the CEN EPBD standards the two countries represented were United Kingdom and France.

In conclusion the complete CENSE-workshop-block within the Concerted Action Meeting underlined the high importance of the CEN-standards, as base for a Europe-wide common method, despite the existing problems in awareness, implementation and content, which need to be addressed. Here, the CENSE-project will play an important role.

Regarding the content of EN ISO 13790, the results of the questionnaire were illustrated and approved by the countries's presentations as well as by the participants.

Additional comments more or less specifically relevant for EN ISO 13790 noted from the country presentations:

- (UK) Some parts of some standards seem (to the UK) to be impracticably detailed and data-intensive for EPBD application; especially for existing buildings; but they may be well-suited to other purposes (*And some Member States might insist on this complexity)*
  ➔ Lesson: Separate the EPBD content from other purposes.

- (UK) Substantive changes to the energy performance calculation methodology would require strong justification: need for rating continuity.

- (France) As we need to update some parts of our methodology, we are interested in useful proposals implemented by Member States. For example :
  Calculation of an indicator of summer comfort (different from the present one : the maximal conventional indoor temperature which is reached the warmest days in summer),
  Calculation of the electricity production by wind turbines
  ➔ Lesson: create a forum for presenting and discussing special calculation procedures.

- (Norway) Make a distinction between three categories of input data for energy calculations:
  Reference data - is default values which can not be altered and shall be used for EPC and benchmarking purposes, e.g. indoor temperature, hours of use, need of DHW, reference climate etc.
  Guiding data - is default conservative input data which can be picked and used if the calculation is simplified. This could be tabulated values, e.g. efficiency factors for different types of buildings systems (heating, cooling, generators, etc.), thermal bridge atlas, air leakages for existing buildings, specific heat capacity for different types of buildings. The other option is to do a detailed analysis and calculated more accurate factors.
  Documented data - is input data which is dependent on the actual building (or at the design stage) and includes solar shading, air flow rates, building size, air tightness (EN 13829) etc. These data will have to be documented for use in the in the calculation of EP.

- (Denmark) There is a lack of integration of buildings and systems (e.g. ventilation is a separate calculation).

- (Denmark) Different EN's use different approaches. ➔ The level of details is different.
  - EN 13790 is an example of good approach and level of details
  - Heat pumps and lighting are example of problematic standards

5.2.2 ASIEPI-CENSE workshop, February 18, 2009 in Stuttgart

The aim of the workshop is to present and discuss common issues for the two EU projects which are dealing with the implementation of the EPBD and the use of related CEN-standards.

Members from the two project groups present activities in related work packages. Presentations introducing the CENSE project and the ASIEPI project are followed by presentations on the status and activities concerning four selected topics with mutual interest. The workshop is concluded with common discussions and identification of actions.

The session "Building energy performance" is mainly devoted to EN ISO 13790 and the thermal transmission standards.

This presentation starts by showing the general framework of the energy performance calculations in the CEN standards and the special role of EN 15603, which provides a common, modular structure.

The first priority for CENSE seems to be to promote this common modular structure to be used in all Member States. The next step could then be to replace gradually national modules by CEN modules. The building energy performance is one of these modules.

The presentation shows the position of the calculation of the building energy performance in the set of CEN standards to support the EPBD. The main standard here is EN ISO 13790, calculation of energy use for heating and cooling.

Question: Is EN ISO 13790 detailed enough on thermal bridges?
Answer: Yes, this standard gives the possibility for detailed calculations of thermal bridges. It references as input the thermal transmission standards which include a detailed thermal bridge calculation method and default values. It is up to the Member States to make use of these standards and, if they do, to organize the control of the calculations.

Question: How to include passive renewables? E.g. calculate the benefit for heating by having more passive load from sunshine?
Answer: EN ISO 13790 provides the calculation method for this, either monthly (energy balance with gain utilization factor), or (simple) hourly method.

5.2.3 CENSE Workshop: Towards Pan-European Software for Building Energy Performance?, June 29, 2009, Brussels

The purpose of this workshop is to explore these issues further, in the context of: - software companies considering the regulatory market as an extension to existing design tools or e.g. as part of building stock maintenance tools, - Member States, especially those who have not yet fully implemented the EPBD. The objectives of the workshop are: - to inform about the present legal situation and the use of such software in Europe - to exchange views and opinions (interest on a common European method, linking regulation and design) - to discuss and identify common actions to push forward the development and application of a European energy calculation. The main objective is to identify if there is an interest of a unified framework and, if this is the case, how to organise to reach this target.

A few items extracted from the presentations and discussions, which are relevant in general, but could also be of specific interest for EN ISO 13790:

— To several participants, the question of hourly or monthly method is a wrong debate, compared to the capacities of the calculation engines; other participants stress that it will be a major challenge to reach international agreement on the descriptions of a common hourly method, covering the building, the systems and the dynamic interactions.
NOTE: The detailed calculation option in EN ISO 13790 does not contain a specific method, but allows any validated calculation procedure. The problem is that the current CEN standards that provide procedures to validate such calculation methods cover only a very small part of the calculation procedures. In addition,

known validation procedures from international research (e.g. IEA BESTESTS) do not cover specific details and/or allow a too wide bandwidth to be of use in the context of building regulations.

- Low energy houses require better calculation models and software, but on the other hand the biggest uncertainty in the model is often in the input data. More complex options sometimes have poor trade-off between data collection and apparent precision.
- ➔ The user interfaces are as important as the content.
- Boundary conditions could be used to determine whether detailed or simplified models should be used.
- Each section of a standard should be a software model.
- The importance of the software developers, as the linking element between the standard writers and the standard users (designers, installers, certificators) in the field of energy performance of buildings was recognized. The software developers will read the standards and apply them in the development of software tools for building professionals. The content of the standards should be "software friendly" and "software proof". Also, in order to achieve energy efficiency in buildings, reliable software tools will definitely be needed.

More details, but not specific on EN ISO 13790, can be found in the workshop report and presentations and in the Information Paper on this workshop (P161).

5.2.4 CENSE workshop – Croatian Ministry of Environmental Protection, Physical Planning and Construction, Directorate for Construction, December 8-9, 2009, Zagreb, Croatia

The 8th and 9th of December 2009 a workshop has been organized in Zagreb by the IEE - CENSE project in cooperation with Croatian Ministry of Environmental Protection, Physical Planning and Construction, Directorate for Construction, who is responsible for building regulations.

The objective of the workshop was to exchange on how Croatia could adopt and adapt the EPBD - CEN standards in their building regulation and software.

For each topic the experts had prepared a short presentation focusing more on their experience with the standards (problems, solutions, choices made, etc) than explaining the standards itself (the participants knew the standards already).The experts explained how they applied the EPBD - CEN standards (national annexes, why they have chosen this or this option).

Conclusions and recommendations:

The Croatian authorities decided to use the experience of other countries and to adopt the EPBD – CEN standards.

Croatia will focus on the development on national annexes like climate data and boundary conditions. Through application of European standards, Croatian experts are provided with the possibility of using software which supports the same set of European standards.

Software will have prescribed obligatory control of their applicability under Croatian regulations. Software applicability control shall be carried out using an algorithm - a tool planned to be developed and which will contain all national additions necessary for the application of European standards.

The Directorate for Construction will also support Croatian experts to participate actively to EPBD - CEN standardization work to bring in their experience directly.

By sticking very close to the EPBD-CEN standards Croatian authorities do not need to finance software. This work can be done by the professionals (software companies).

A few items extracted from the presentations and discussions, which are of specific interest for EN ISO 13790:

— (SK) EN ISO 13790 is a very complex standard, containing more methods and requiring a lot of inputs from other CEN standards.
Problem of standards (not only EN ISO 13790:2008) is that it is difficult to produce one CEN standard to be appropriate for software developers or national experts and at the same time for individual experts, certifiers.
- Software developers, national experts need: all possible options, also detailed, calculation procedures and indexes appropriate for computer algorithms.
- Individual certifiers-experts (Experience from trainings): feel unhappy and complain: too long, too complicated, too many possibilities, too many indexes ... in reality do not use directly the standard.
Possible solutions for countries:
- copying the relevant parts as national standard (?);
- national annexes + user friendly software
(SK - more appropriate way for common methodology, less expensive for small countries)

— (SK) The presentation from Slovakia contains a detailed introduction to the elements and national choices which are laid down in a National Annex to EN ISO 13790 (for more details see the presentation by Jana Bendžalová (Building Testing and Research Institute)

— (Cro) The country presentation on the energy performance calculation structure in Croatia contains a clear overview of the national implementation of EN ISO 13790: for each of the calculation steps in this standard: which options are selected and which input data; plus the link with minimum component requirements (for more details see the presentation by Prof. Igor Balen)

5.2.5 Other workshops

Similar feedback was obtained at other workshops. See overview of workshops and the workshop reports that can be downloaded at the website.

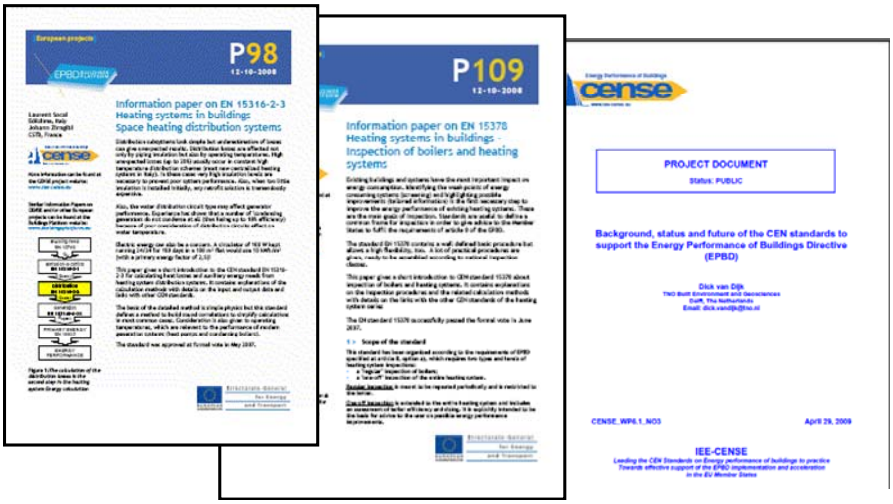
5.3 Conclusions from the workshops

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

At some of the workshops presentations were given on the national or regional implementation of EN ISO 13790 and other standards which underline the recommendations, but provide very interesting details on the experience, national practice and proposed improvements. 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. The most relevant country presentations are mentioned in the paragraphs above.

6 More information

More information, including summary and detailed information on the CEN standards and other interim reports with results of feed back from the target groups, can be found at the website: www.iee-cense.eu.



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ANNEXES

In the following Annex A a method will be introduced that is suited to integrate an aspect that has not been sufficiently covered (or not considered at all) in the CEN standard EN ISO 13790: a correction factor for the spatial average set point temperature in residential buildings the difference between poorly and highly insulated buildings with respect to the spatial internal temperature levelling.

It is meant to serve as a precise suggestion for the required change, identified during the inquiries made by means of a questionnaire and in workshops within the CENSE-project, as described in paragraph 4.1.3 and summarized in the recommendations (paragraph 1.2).

Several suggestions for other changes were provided too (see previous paragraphs), but not in the form of precise worked out suggestions.

Annex A
Simple method to adjust the set point temperature in residential buildings taking into account moderately versus fully conditioned spaces

Background

Residential buildings contain spaces that are used for inhabitants to live in, and other spaces. The other spaces may e.g. be unheated (unconditioned) spaces. The living spaces comprise living room, kitchen, bathroom, bedrooms, spaces for study and/or hobby and combinations of these.

The living room plus (depending on the national tradition or regulations) e.g. the kitchen and bathroom are assumed to be fully heated/conditioned ("**fully conditioned**"): the temperature set point for the calculation of the energy needs for heating and cooling is set to a level that provides adequate thermal comfort. At national or regional level a correction for night time temperature set back can be added plus the terms when and how energy use for heating and cooling shall be taken into account.

Some of the spaces, such as bedrooms, spaces for study and/or hobby and combinations of these are only heated/conditioned partially ("**moderately conditioned**"), depending on the occupation; for instance only a few days per week or a few hours per day heated/conditioned at high comfort level (same as living room) and for the other days often at a reduced comfort level.

The **unconditioned spaces** are taken into account in EN ISO 13790 by the adjustment factor b_{tr} and b_{ve}, for the adjusted temperature difference between the conditioned and unheated spaces compared to the indoor-outdoor emperature difference.

For taking into account the temperature difference between fully conditioned and moderately conditioned spaces EN ISO 13790 does not provide a method, unless the building is partitioned into different zones, one for the fully conditioned, the other for the moderately conditioned spaces. Such partitioning is however not evident: is severely complicates the gathering of input data and it may be impossible (or against national/regional regulations) to assign a specific use to specific spaces. In the latter case only a certain (nationally set) percentage of the living spaces is assumed to be fully conditioned and the rest moderately conditioned.

To take into account the difference in fully and moderately conditioned living spaces, it is not sufficient to assume a reduced temperature set point. For instance: 20 °C for fully conditioned ➔ 18 °C as average indoor set point temperature for all conditioned spaces. This is because this reduction strongly depends on the spatial temperature levelling inside the building, which is a function of the ration between the overall heat transfer coefficient between the fully conditioned and the moderately conditioned spaces and the overall heat transfer coefficient of the building envelope.

In other words: the moderately conditioned spaces will obtain some of the heat (cold) by transmission and ventilation from the fully conditioned spaces. This levelling of the internal temperature between the different spaces in the building will be much more significant in case of a highly insulated and airtight building envelope.

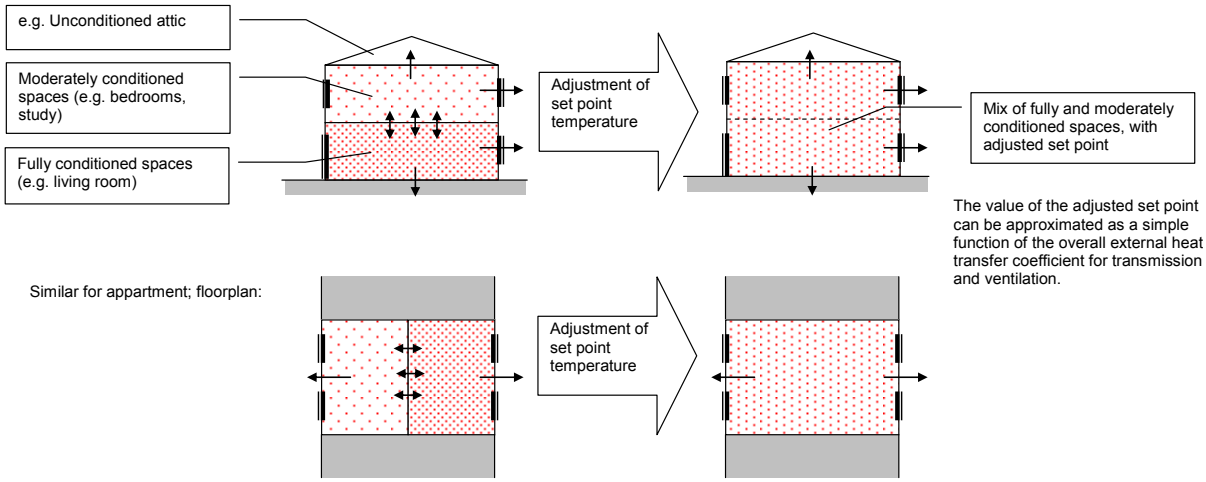

Fig. A1 – Illustration of the adjustment explained in the text

This is one of the reasons why it makes sense to make a difference between the set point temperature of a "passive house" and an old uninsulated house.

> Note that other reasons for a temperature difference between poorly and highly insulated buildings in general are (for heating, but similary *mutatis mutandis* for cooling): are already taken into account in EN ISO 13790:
>
> a) Solar heat gains are more often a surplus in highly insulated building, leading to an increased indoor temperature. This effect is already taken into account in EN ISO 13790 by the gain utilization factor (monthly method) or by the hourly heat balance (hourly method).
>
> b) Air temperature in older buildings is often lower due to higher air leakages. This effect is already taken into account in EN ISO 13790 by recommending the use of the operative temperature as set point; in that case the lower air temperature is compensated by a higher radiation temperature.
>
> c) Older buildings are typically heated/conditioned at a reduced comfort level. If this effect is taken into account in the energy performance calculation it leads to a bonus for bad comfort. Therefore, the usual nationally/regionally determined assumption is that the calculation is to be done at equal thermal comfort level for the living spaces.
>
> d) Poorly insulated buildings have a lower timeconstant, so the effect of night time temperature set back is larger. This effect is already taken into account in EN ISO 13790 by the correction for intermittency (monthly method: a function of the timeconstant and the heat balance ratio) or by the hourly calculation (hourly method).

Solution

Introduction of a factor taking into account the variation in spatial temperature levelling for the conditioned spaces inside dwellings, as a function of the overall heat transfer coefficient of the building envelope.

The method is derived from the final draft of the new Dutch standard NEN 7120:2010.

The method is intended for use in case the fully conditioned spaces (such as living room, kitchen, ..) and the moderately conditioned spaces (such as bedrooms, studies), for reasons explained above, are not calculated as separate calculation zones.

The result is a corrected average setpoint temperature that is a few degrees lower for old uninsulated dwellings than for passive houses.

Method

For accounting the difference in spatial levelling of the temperature between the fully and the moderately conditioned spaces inside a residential building an adjustment to the temperature setpoint is applied.

The set point for heating, including adjustment, is calculated as follows:

$$\theta_{int;set;H;adj} = \frac{\left(f_{mod;sp} \times H_{e;H;spec} + H_{int;spec}\right) \times \theta_{int;set;H;high} - f_{mod;sp} \times f_{mod;t} \times H_{e;H;spec} \times \left(\theta_{int;set;H;high} - \theta_{e;H;repres}\right)}{f_{mod;sp} \times H_{e;H;spec} + H_{int;spec}} \quad (A.1)$$

NOTE 1 The equation contains only fixed parameters to be determined at national level, except one case-specific variable: $H_{e;H;spec}$, which is already calculated for other purposes. Consequently it does not require additional input.
Because the equation aims to provide only a first order correction, a rough approximation of all nationally fixed parameter values provides sufficient accuracy, also because in individual situations the actual geometry, use of the spaces and the internal heat exchange (in particular by ventilation) will strongly vary anyway. This is also the reason for not differentiating per month or hour. See also the worked example further on. See also note 3 for an amended procedure.

where:

$\theta_{int;set;H;adj}$ is the calculation value for the adjusted set point temperature for heating in the fully and moderately conditioned spaces in a residential building, expressed in degrees Celsius;

$H_{int;spec}$ is a nationally fixed parameter representing the specific internal heat transfer coefficient for transmission and ventilation, per unit of conditioned floor area of the building, between the fully conditioned and the moderately conditioned spaces , expressed in watts per Kelvin per square meter;
value in absence of a national value: $H_{int;spec}$ = 1 W/(m^{2}K);

$\theta_{int;set;H;high}$ is the nationally fixed value for the set-point temperature for heating for the fully conditioned spaces during the days and hours with required high comfort, expressed in degrees Celsius;

NOTE 2 For example: $\theta_{int;set;H;high}$ = 20 °C; note that night time temperature set back is accounted for by a separate factor.

$f_{mod;sp}$ is a nationally fixed parameter representing the fraction in floor area of the moderately conditioned spaces compared to all fully plus moderately conditioned spaces;
value in absence of a national value: $f_{mod;sp}$ = 0,5;

$f_{mod;t}$ is a nationally fixed parameter representing the time fraction that the moderately conditioned spaces (on average) are operated at moderate comfort level instead of at high comfort level;
value in absence of a national value: $f_{mod;t}$ = 0,4;

$\theta_{e;H;repr}$ is the nationally fixed parameter representing the average outdoor temperature during the heating season, expressed in degrees Celsius;

$H_{e;H;spec}$ is the specific overall heat transfer coefficient for transmission and ventilation, expressed in watts per Kelvin per square meter, determined according to:

$$H_{e;H;spec} = \frac{H_{tr;H;adj} + H_{ve;H;adj}}{A_f} \quad (A.2)$$

where:

$H_{tr;H;adj}$ is the overall heat transfer coefficient by transmission for the calculation of the energy needs for heating, adjusted for the indoor-outdoor temperature difference, calculated in accordance with 8.3 of EN ISO 13790:2008, expressed in watts per kelvin;

$H_{ve;H;adj}$ is the overall heat transfer coefficient by ventilation for the calculation of the energy needs for heating, adjusted for the indoor-outdoor temperature difference, calculated in accordance with 9.3 of EN ISO 13790:2008, expressed in watts per kelvin.

A_f is the conditioned floor area, in accordance with 6.4, expressed in square metres;

In case $H_{tr;adj}$ and/or $H_{ve;adj}$ are different per month (e.g. because it comprises a heat transfer coefficient via the ground floor which is different each month due to the ground inertia), it has to be determined at national level which value (in casu which month) shall be taken.

NOTE 3 Because $H_{e;H;spec}$ is in itself a function of the set point temperature (via $H_{tr;H;adj}$ and $H_{ve;H;adj}$ which are-adjusted for the indoor-outdoor temperature difference) a calculation loop is created. This has to be resolved by separating the calculation of these overall heat transfer coefficients from the calculation of the adjustment of the setpoint. One of the solutions is to introduce the adjustment of the setpoint temperature as a correction factor to the calculation of the heat transfer by transmission and ventilation ($Q_{tr;H}$, $Q_{ve;H}$) instead of as a corrected setpoint temperature, which would lead to: $f_{adj} = ((1- f_{mod;t}) \times f_{mod;sp} H_{e;spec} + H_{i;spec})/(f_{mod;sp} H_{e;spec} + H_{i;spec})$.

The same approach, mutatis mutandis, can be used for adjusting the cooling set point.

NOTE 4 $H_{tr;adj}$ and/or $H_{ve;adj}$ are often different between heating and cooling mode (e.g. due to free cooling by night ventilation).

Example:
Nationally determined values:
$\theta_{e;H;repr}$ = 5 °C;
$\theta_{int;set;H;high}$ = 20 °C;
$H_{int;spec}$ = 1 W/(m^{2}K);
$f_{mod;sp}$ = 0,5;
$f_{mod;t}$ = 0,4;
This leads to the simple equation with only one case-specific variable ($H_{e;H;spec}$):

$$\theta_{int;set;H} = \frac{(0{,}5 \times H_{e;H;spec} + 1) \times 20 - 0{,}2 \times H_{e;H;spec} \times 15}{0{,}5 \times H_{e;H;spec} + 1}$$

For instance:

Type of residential building	Poorly insulated	Highly insulated	Passive house like
$H_{e;H;spec}$ (W/(m^{2}K))	2,0	0,8	0,4
$\theta_{int;set;H}$ (°C)	17,0	18,3	19,0

Conclusion: the correction is both simple and significant.