Grant agreement no EIE/07/069/SI2.466698

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

Intelligent Energy – Europe (IEE)

VKA1, SAVE, Multiplying success in buildings

**Final Public Report**

Period covered: from October 1, 2008 to March 31, 2010

Due date: May 31, 2010

Submission date: July 1, 2010

Start date of the action: October 1, 2008
End date of the action: March 31, 2010

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1 Executive Summary

1.1 European energy consumption developments in building
Energy consumption in buildings represents close to 40% of the world’s total energy use, including climate control and energy used for appliances, lighting and other installed equipment. There are many ways to reduce the energy requirements of buildings. The potential savings from energy efficiency in the building sector would contribute substantially to a worldwide reduction in energy consumption. The implications should not be underestimated, as the scale of energy efficiency in buildings is large enough to influence security policy, climate protection and public health on a national, European and global scale.

1.2 The CENSE project
The aim of the CENSE project (2007-2010) is to support the EU Member States (MS) and other target groups in achieving better awareness and more effective use of the European (CEN) standards that are related to the Energy Performance of Buildings Directive (EPBD).

The main activities in the project are to provide guidance on the standards, to collect comments and examples of good practice, so as to remove obstacles to implementation and to prepare recommendations to CEN.

1.3 CEN - EPBD standards towards a European common methodology
The set of CEN (CEN-ISO) standards developed under the European Commission's mandate to CEN to support the EPBD were successively published in the years 2007-2008 and are currently either already being implemented or will soon (at least partially) be implemented in many EU Member States.

The initial time schedule for the development of these "first generation" standards was very short. Consequently, it should not come as a surprise that an update, a "second generation" of standards, is needed.

The response via questionnaires and workshops prove that there is a wide interest by many target groups in Europe, comprising industry, professionals, standard writers, software companies, but also consumers' organisations.

Main conclusions are the following:
- There is a strong interest in a second generation of EPBD - CEN standards to assess the energy performance of buildings. Based on the experience of the first generation, a second generation is needed to facilitate the implementation in the EU Member States, to disseminate the European experience as a support to the European Industry and to enhance harmonization at global level (bring CEN standards to ISO).
- There is a need of positive signals towards a European common methodology.
Second generation of EPBD - CEN standards

The first generation of CEN standards to support the EPBD were published in the years 2007-2008 and were implemented in many EU Member States "in a practical way", mixed with national procedures, boundary conditions and input data.

The CENSE project prepared recommendations to CEN to develop a second generation of standards in the coming years.

The current standards present possible methodologies, which makes direct implementation on a national level nearly impossible. A Member State can only develop a calculation procedure based on the EN standard method of choice. This results in large differences in the final energy performance of buildings calculation procedures across countries.

What is needed is a second generation which presents calculation procedures with a clear indication of what values or procedures should be given in National Annexes, containing rational and consistent options which are unambiguous and software proof. This has to promote direct use of the standards resulting in European uniformity.

As a consequence, some concrete recommendations are made as presented further on.

1.4 Focus of the action: CEN EPBD standards

The role of the EPBD-CEN standards is to provide a common European concept and common methods for preparing energy performance certification and energy inspections of buildings. However, the implementation of these CEN standards in the EU Member States (MS) is far from trivial: the standards cover a wide variety of levels and a wide range of interlaced topics from different areas of expertise. They comprise different levels of complexity and allow differentiation and national choices at various levels for different applications.

The CEN standards to support the EPBD were successively published in the years 2007-2008. On the long term, increased harmonisation of the methods will be attractive for all Member States. The development of CEN standards may also lead to CEN-ISO standards. Several CEN-EPBD standards are already EN-ISO standards. The ISO standards may increase the market opportunities of the European industry.

1.5 Regional differences

The European Commission supported the development of the set of CEN standards by giving a mandate to CEN (M343) to produce the standards needed to support the implementation of the EPBD. It will be beneficial for Europe if all Member States use these standards as reference. However building regulation is an area where the EU Member States claim their national privilege to formulate the national legislation (also the EPBD adopted the subsidiarity principle in this respect).

Regional differences in climate, building tradition, legal settings, quality assurance and user behaviour in Europe will have impact on the input data and consequently on the energy performance. These differences will also lead to different choices when it comes to finding the optimum balance between accuracy and simplicity. The standards developed under the EPBD have to be flexible enough to accommodate these differences.

Consequently, although most MS say they use the CEN standards as a basis, as these procedures are in accordance with the EPBD, most of the Member states do not require the direct use of these standards.
### 1.6 CENSE impact and conclusions

The CENSE project organized the information on the CEN standards and the feedback from the Member States, to prepare recommendations to CEN for the next generation of CEN (and/or CEN-ISO) standards on the energy performance of building.

**The following main conclusions** can be derived from the project:

**Consistency, Structure and Format**
To enable and encourage the further use of the European CEN-standards, a clear and uniform structure is essential, for each standard.

- With a distinction between common procedures and options to be chosen at national level; this will bring more clarity in the adoption of the procedures and the specific choices per country;
- Fully spelled out equations and unambiguous links between input and output, making the standards ready-to-use for validation and software preparation;

It also includes the preparation of an overall continuous but modular structure, e.g. in the form of a basic standard on the integrated energy performance of buildings, re-using the main elements of EN 15603 (Overall energy use and definition of energy rating) and core elements of other key standards, including common definitions, terms and symbols, enabling a step-by-step implementation by the Member States, taking also into account the nature of each procedure identifying the typical type of user. Preparing and applying a systematic hierarchic numbering of the standards of the set could be an additional asset.

**Applicability**
Several aspects are essential to ensure and improve the standards applicability. First, the standards are meant to serve as a framework, to enable national flexibility encouraging the countries to apply them. Second, the options possible need to be rationalised, with each option aiming at specific applications with respect to availability of input data and impact on the energy performance. Third, the standards must cover all tasks and building types, such as existing buildings, retrofitting or planning of new buildings, including the early planning period. This includes identifying and taking care of existing gaps. In addition, the standards’ methodologies should be “software-proof”, keeping in mind that software-developers will implement the methods creating usable software-tools. In consequence of increasing software use there is generally no need for simplified procedures but for simplified input data.

**Keeping the standards up to date**
To keep up with rapid innovative development in the building related energy field (regarding all issues, e.g. technical systems, control techniques or building components), it is essential to promptly include respective calculation procedures. Close cooperation with industry and research centres as well as regular reviews, will help to fulfill this challenging task. Until appropriate computer programs are developed a general feeling is that the EPBD standards are too complicated to use.

In the future, the CEN standards should be read mainly by software developers because the standards will only be applied efficiently by high quality tools.
The transposition of the standards in national regulation
The project confirms the interest on energy aspects in Member States but the application at national level is not easy. The application of the EPBD standards differs very much from country to country. A common structure might help. It is recommended that the next set of standards should have a common format, such as:

- Nomenclature: to present all parameters and unities
- Description of the technique and physic models
- Providing examples in annexes
- Flowchart: to present the calculation model and to facilitate the implementation on software.
- To increase the adoption of these standards, an excel sheet should be proposed
- Guidelines how to establish national annexes should be established

Technical recommendations:
Per cluster of standards on a specific subject technical recommendations have been prepared by the CENSE teams who focused on a specific subset of the CEN-EPBD standards. These technical recommendations can be found in the separate reports.

The expected impact of a second generation of CEN-EPBD standards:
- CEN standards are more usable as direct reference; high transparency in national choices
- Easier international knowledge exchange and shared research
- Increased circulation of products, services and property data
- Faster implementation of new solutions
- Increased credibility of EU in the world

with the main aim: High performance European tools leading to high performance buildings

1.7 Next steps

The standards are worked out in such a way that direct practical use, without supporting national information (national annexes), may be difficult. In some EU Member States part of the content will be found in national publications or regulations, in some other MS using the EPBD standards is always an alternative solution.

Various target groups underline the benefits of a Europe wide unified framework (knowledge share, avoid of duplications of efforts, fair competition, more transparency and better chances for innovation).

The first EPBD – CEN package has in general already a good quality compared to national methods. The quality and usability would be increased by the second generation.
But how to get the Member States to make the switch from their national method, in which also a lot of effort has been invested (e.g. training of the professionals) to the European method, especially on a short notice?

To bring the EPBD – CEN package to application there are several options. There are substantiated hesitations from the side of the Commission to enforce a 100% mandatory application. But waiting until the national methods are voluntarily replaced by the European methods is another extreme position. A third option, using the market forces, could lead to a soft convergence of national and the European method. In this option, a methodology, based on the EPBD - CEN package, should be admitted in parallel to the national method, to fulfill the national building codes requirements. The justification would be that national monopolistic positions for methodologies and software are not compatible with the objective of a European market. At the same time it would stimulate countries to write National Annexes or National Application Documents if and where they fear that the parallel routes would lead to different results.

But a neater and better organized second generation of CEN standards will be necessary to make this a feasible option in practice.

A contribution to the perspective of EU-wide application of the EPBD-CEN standards, is the expectation that the comparative methodology framework to identify cost-optimal levels of energy performance requirements for buildings and building elements, an important element in the EPBD recast, should be based on European standards (recast annex III).

On the long term, harmonisation of the standards will also be attractive for all Member States. The maintenance and further development costs will be lower compared with the situation where all MS have to do this on their own. In addition, there is great advantage in having harmonised standards throughout Europe. The wide scale implementation of new technical solutions, equipment and systems will become easier if the performance is calculated in a similar way. This means that the industry may have a bigger market throughout Europe which may also benefit their opportunities on the world market.
2. Background: CEN - EPBD standards

2.1 The Energy Performance of Buildings Directive (EPBD)

The Energy Performance of Buildings Directive (EPBD) is set to promote the improvement of energy performance of buildings, with the following requirements to be implemented by the Member States:

- a general calculation framework on the energy performance of buildings,
- the application of minimum energy performance requirements for certain categories of buildings,
- energy performance certification of buildings and inspection of certain technical systems in buildings.

2.2 Mandate to CEN for European standards to support the EPBD

The European Commission gave a Mandate (M343) to CEN to develop a calculation methodology for the integrated energy performance of buildings in accordance with the terms set forth in the EPBD. These European standards aim to increase the accessibility, transparency and objectivity of energy performance assessment in the Member States.

2.3 Status and role of the CEN standards

The role of the EPBD-CEN standards is to provide a common European concept and common methods for preparing energy performance certification and energy inspections of buildings. On the long term, increased harmonisation of the methods will be attractive for all Member States. The development of CEN standards may also lead to CEN-ISO standards. The ISO standards are widely accepted and may even increase the market opportunities of the European industry. The CEN standards to support the EPBD were successively published in the years 2007-2008 (see ref 1 for the so called “Umbrella Document”).

The role of the EPBD-CEN standards is to provide a common European concept and common methods for preparing energy performance certification and energy inspections of buildings. However, the implementation of these CEN standards in the EU Member States (MS) is far from trivial: the standards cover a wide variety of levels and a wide range of interlaced topics from different areas of expertise. They comprise different levels of complexity and allow differentiation and national choices at various levels for different applications.

The commission supported the development of the CEN standard by giving a mandate to CEN to produce the standards needed to support the implementation of the EPBD. It will be beneficial for Europe if all Member States use these standards as reference. However building regulation is an area where the EU Member States claim their national privilege to formulate the national legislation (also the EPBD adopted the subsidiarity principle in this respect). Regional differences in climate, building tradition, legal settings, quality assurance and user behaviour in Europe will have impact on the input data and consequently on the energy performance. These differences will also lead to different choices when it comes to finding the optimum balance between accuracy and simplicity. The standards developed under the EPBD have to be flexible enough to accommodate these differences.
Consequently, although most MS say they use the CEN standards as a basis, as these procedures are in accordance with the EPBD, most of the Member states do not require the direct use of these standards.

The standards are worked out in such a way that direct practical use, without supporting national information (national annexes), may be difficult. In some MS part of the content will be found in national publications or regulations, in some other MS using the EPBD standards is always an alternative solution.

On the long term, harmonisation of the standards will also be attractive for all Member States. The maintenance and further development costs will be lower compared with the situation where all MS have to do this on their own. In addition, there is great advantage in having harmonised standards throughout Europe. The wide scale implementation of new technical solutions, equipment and systems will become easier if the performance is calculated in a similar way. This means that the industry may have a bigger market throughout Europe which may also benefit their opportunities on the world market.

The CENSE project organizes the information on the CEN standards and the feedback from the Member States, to prepare recommendations to CEN for the next generation of CEN (and/or CEN-ISO) standards on the energy performance of buildings.

2.4 The global perspective: ISO

Practical tools in the form of standards are also needed at global level. Consequently, there are also initiatives in ISO on standardization of energy performance of buildings. Some of the developed and/or updated EPBD CEN standards have already been voted in parallel. This means that these standards are CEN standards and ISO standards at the same time. This includes EN ISO 13790 as well as the series of standards dealing with thermal transmission properties.

This work is done in parallel in ISO Technical Committee TC 163, "Thermal performance and energy use in the built environment". Also other ISO Technical Committees are preparing draft standards that are related to the energy performance of buildings, e.g. in ISO/TC 205, "Building environment design".

It is expected that more of the current EPBD CEN standards may be adopted by ISO/TC 163 and/or ISO/TC205 as well. This means that the current EN’s may become EN ISO standards. This could be done without changing the technical content of the current EN's.

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

The ISO standards are widely accepted and may even increase the market opportunities of the European industry.

The timing of periodic revision of the CEN standards (typically 5 years after the publication) coincides well with the intended publication date of ISO standards on energy performance of buildings (typically 2 to 3 years from now), as figure 7.8 shows.

There is indeed a strong interest of ISO in the subject, which culminated in the recent (June 2009) establishment of a Joint Working Group in ISO to develop ISO (EN ISO) standards on energy performance of buildings, using the EPBD - CEN standards as a basis. This creates a unique opportunity for Europe to retain the lead on the preparation of energy performance standards in a combined CEN-ISO effort.
2.5 Next steps

Various target groups underline the benefits of a Europe wide unified framework (knowledge share, avoid of duplications of efforts, fair competition, more transparency and better chances for innovation).

The first EPBD – CEN package has in general already a good quality compared to national methods. The quality and usability would be increased by the second generation.

But how to get the Member States to make the switch from their national method, in which also a lot of effort has been invested (e.g. training of the professionals) to the European method, especially on a short notice?

To bring the EPBD – CEN package to application there are several options:

- Wait until the national methods are voluntarily replaced by the European methods;
- Make the application of the EPBD – CEN package mandatory;
- Give the market forces the possibility to do it.

The first option will probably take a lot of time, because the driving forces are national, with a stronger national interest than a European one.

The second option is strongly supported by target groups working on the European level, because the national methods raise new barriers for the free circulation of products and services in Europe. For several reasons, there are hesitations from the side of the Commission to enforce a 100% mandatory application.

The third option, using the market forces, could lead to a soft convergence of national methods and the European one. In this option, a methodology, based on the EPBD - CEN package, should be admitted in parallel to the national method, to fulfil the national building codes requirements. The justification would be that national monopolistic positions for methodologies and software are not compatible with the objective of a European market. At the same time it would stimulate countries to write National Annexes or National Application Documents if and where they fear that the parallel routes would lead to different results. A neater and better organized second generation of CEN standards could make this a truly feasible option; although in some Member States the use of the EPBD – CEN package as an option to fulfil the national building codes requirements (without further national specification) is already authorised.

A contribution to the perspective of EU-wide application of the EPBD-CEN standards, is the expectation that the comparative methodology framework to identify cost-optimal levels of energy performance requirements for buildings and building elements, an important element in the EPBD recast, should be based on European standards (recast annex III). It will be very constructive to benchmark the national methods by the unified European methodology, to analyse the differences and to update the methods by the best practice. The CENSE partners are looking forward to discuss with DG ENER how to avoid that the development of the common method for cost-optimum calculations and the preparation of the second generation of CEN standards will diverge and miss the opportunity of synergy. In this respect we should learn from the lack of compatibility in the procedures developed under the EuPD with the EPBD - CEN package.
3. The Outcome of the CENSE project

3.1 Approach

The aim of the CENSE project (2007-2010) is to support the EU Member States (MS) and other target groups in achieving better awareness and more effective use of the European (CEN) standards that are related to the Energy Performance of Buildings Directive (EPBD). These standards were successively published in the years 2007-2008 and are currently either already being implemented or will soon be implemented in many EU Member States. Sometimes “as is”, but more often “in a practical way”.

The main activities in the project are:

1) to communicate the role, status and content of these standards as widely as possible, and to provide guidance on their implementation;

2) to collect comments and examples of good practice from the MS, so as to remove obstacles to implementation, and to collect and secure results from relevant SAVE and FP6 projects;

3) to prepare recommendations to CEN.

More information on the project can also be found in the Information Paper P86, The CENSE project. Leading the CEN Standards on Energy performance of buildings to practice. A project (2007-2010) under the Intelligent Energy Europe programme (ref 1). This is one of a series of Information Papers that can be downloaded from the website (www.iee-cense.eu).

3.2 Description of the activities

General
To achieve the project's objectives, the following three types of activities were defined:

1. Support implementation
   - To widely communicate the role, status and content of the CEN (ISO) standards for the EPBD
   - To act as a centre of expertise for M.S.; to assist M.S. with additional information and provide guidance on the implementation/remove barriers

2. Collect experiences
   - To collect comments and suggestions from MS that implement the CEN (ISO) standards or use elements from the CEN (ISO) standards
   - To collect and secure results from IEE SAVE and FP6 projects that are relevant for the future development of the CEN standards
   - To communicate with other major stakeholders (architects, industry represented by manufacturers organisations) on the CEN (ISO) standards and their implementation
• To respond to questions from the European Commission or EDMC on the CEN (ISO) standards and their implementation

3. Prepare recommendations
• To prepare recommendations for the revision of the CEN (ISO) standards under Mandate M343 and related product standards.

3.3 Results

The project results can be summarised in the following main topics

3.3.1 Production of background information
To provide general information to the stakeholders about the CEN-EPBD standards two general documents are developed. These documents are available in 9 languages (English, German, French, Danish, Finnish, Dutch, Polish, Italian and Spanish). Figure 3.1 gives a general overview of the standards related to CEN-EPBD.

Archiving document-1:
This document describes the background, status and future of the CEN standards to support the Energy Performance of Buildings Directive (EPBD), see ref 2. It explains the system of the CEN standards combined with or referring to general information papers on CEN standards (see ref 1). It puts the spotlight on three of the CEN top level standards:
- EN 15217: Energy performance of buildings – Methods for expressing energy performance and energy certification of buildings
- EN 15603: Energy performance of buildings - Overall energy use and definition ratings
- EN ISO 13790: Thermal performance of buildings – Calculation of energy use for space heating and cooling.

Fig. 3.1 — Basic scheme of CEN standards
Additionally it clarifies the use of common definition, symbols and subscripts in the standards. Many of the standards were not developed from scratch, and each standard was prepared by a group of experts organised within one of the CEN Technical Committees, each with their specific background and expertise (building, heating, ventilation, lighting, etcetera). This was also reflected in the terminology, which was not necessarily the same in all CEN Technical Committees and which could easily lead to a Babel-like confusion. Figure 3.2 shows, as example, a number of terms that were found to be used for energy need and energy use, without a clear picture whether these terms had the same or a different meaning.

![Fig. 3.2 — Tower of Babel or towards common definitions?!](image)

Consequently, one of the important actions in CEN was the preparation of a set of common definitions on the main concepts and physical quantities. Due to the limited time available to develop the standards the preparation of common definitions was carried out in parallel with and even partly after the drafting of the standards. The coordinating task force, CEN/BT TF 173 (currently called CEN/BT TC 371) was responsible for this action. The action focused on harmonization of terms used in the top level standards. The CEN standards to support the EPBD introduce a large number of quantities and their associated symbols. To facilitate the use of the standards, a common set of symbols and subscripts have been defined. In total, more than 100 terms have been selected that are common to the top level CEN standards to support the EPBD. The list, illustrated in figure 3, is adopted as annex C of CEN/TR 15615, the "Umbrella Document" (see ref 2). A few examples are given in the text box below. Most of these definitions can also be found in the top level CEN standard EN 15603. Information Papers P087 and P088 provide more information on that standard.
Arching document-2:
This document is meant for guiding the use and implementation of the CEN standards and gives the final set of recommendations: towards a second generation of CEN standards related to the Energy Performance of Buildings Directive (EPBD, see ref 3).

The set of CEN (CEN-ISO) standards developed under the European Commission's mandate to CEN to support the EPBD were successively published in the years 2007-2008 and are currently either already being implemented or will soon (at least partially) be implemented in many EU Member States.

The initial time schedule for the development of these "first generation" standards was very short. Consequently, it should not come as a surprise that an update, a "second generation" of standards, is needed. This CENSE report contains a draft set of conclusions and recommendations, based on feedback from and discussion with the target groups. Questions to be addressed were:

- What remains to be done to realise the full potential of the standards?
- How to combine efforts to bring the standards to application?

The response via questionnaires and workshops prove that there is a wide interest by many target groups in Europe, comprising industry, professionals, standard writers, software companies, but also consumers' organisations.

Main conclusions are the following:
- There is a strong interest in a second generation of EPBD - CEN standards to assess the energy performance of buildings. Based on the experience of the first generation, a second generation is needed to facilitate the implementation in the EU Member States, to
disseminate the European experience as a support to the European Industry and to enhance harmonization at global level (bring CEN standards to ISO).

- There is a need of positive signals towards a European common methodology.

The first generation of CEN standards to support the EPBD were published in the years 2007-2008 and were implemented in many EU Member States "in a practical way", mixed with national procedures, boundary conditions and input data.

The CENSE project prepared recommendations to CEN to develop a second generation of standards in the coming years.

The current standards present possible methodologies, which makes direct implementation on a national level nearly impossible. A Member State can only develop a calculation procedure based on the EN standard method of choice. This results in large differences in the final energy performance of buildings calculation procedures across countries.

What is needed is a second generation which presents calculation procedures with a clear indication of what values or procedures should be given in National Annexes, containing rational and consistent options which are unambiguous and software proof. This has to promote direct use of the standards resulting in European uniformity.

As a consequence, some concrete recommendations are made as presented further on.

**Information papers and presentations**

Within the framework of the project 37 Information Papers were produced, together with PowerPoint presentations, giving background information about the CEN standards. These may be used by the stakeholders to learn more about the use of the standards or for e.g. teaching purposes. The project also focussed on universities to take up courses about the CEN-EPBD related items in their education. The following Information Papers and PowerPoint presentations are produced within the various working fields.

**Topic: General**

- IP 86: The CENSE project. Leading the CEN Standards on Energy performance of buildings to practice
- IP 87: How to integrate the CEN-EPBD standards in national building regulations?
- IP 90: The use of the CEN standards to support the EPBD in the EU Member States. An overview and some typical examples
- IP156: Energy performance certification for new and existing buildings
- IP 161: Towards Pan-European Software for Building Energy Performance

**Topic: Overall Energy Performance of Buildings**

**Cluster 1: Common definitions and symbols for the set of European standards on energy performance of buildings**

- IP 154 Information paper on the common definitions and common symbols for EPBD related CEN standards (+PP)
Cluster 2: Methods for expressing energy performance and for energy certification of buildings


Cluster 3: Overall energy use and definition of energy ratings

- IP 88  Information paper on Energy performance of buildings - Overall energy use and definition of energy ratings – Calculated energy rating  EN 15603 (Overall energy use)
- IP 89  Measured or operational energy performance of buildings
  Procedures for defining measured energy use and operational ratings and for presenting measured energy performance results on building energy certificates

Topic: Building Energy Performance

Cluster 1: Lighting

- IP 91:  A vehicle for energy-efficient lighting: EN 15193: Energy performance of buildings - Energy lighting requirements

Cluster 2: Energy use for heating and cooling

- IP 92:  Information paper for the EN ISO standard on energy use for heating and cooling  EN ISO 13790 (Energy performance of Buildings – Energy use for space heating and cooling)
- IP 93:  The effects of passive heating and cooling on the energy performance of buildings – CEN calculation procedures
- IP 95:  The different CEN approaches for calculating the energy use for heating and cooling

Cluster 3: Calculation of heat transmission

- IP 94:  Information paper for the series of EN ISO standards on thermal transmission properties of building components and building envelope EN ISO 6946, 10077, 10211, 10456, 13370, 13786, 13789, 14683; EN 13947

Topic: Heating Systems and Domestic Hot Water

General introduction


Cluster 1: Domestic Hot Water

- IP99:  Domestic Hot Water systems – Characterisation of Needs (tapping requirements)
- IP100:  Domestic Hot Water systems – Distribution
- IP101:  Domestic Hot Water systems – Generation
Cluster 2: Space heating

- IP97: Heating systems in buildings – Space heating emission systems
- IP98: Heating systems in buildings – Space heating distribution systems
- IP102: Space heating generation systems – Combustion systems
- IP103: Space heating generation systems – Heat pump systems
- IP104: Space heating generation systems – Thermal solar
- IP105: Space heating generation systems – Combined heat and power systems
- IP106: Space heating generation systems – The performance and quality of district heating and large volume systems
- IP107: Space heating generation systems – Photovoltaic systems
- IP108: Space heating generation systems – Biomass Combustion systems
- IP162: Space heating generation systems – Operating conditions and multiple generators

Topic: Ventilation and Cooling Systems

Cluster 1: Ventilation

- IP 110: Information paper on EN 15242 – Ventilation for buildings – Calculation methods for the determination of air flows rates in buildings including infiltration
- IP 111: Information paper on EN 15241 – Calculation methods for energy losses due to ventilation and infiltration
- IP 112: Information paper on EN 13779 – Ventilation performance requirements for ventilation and room-conditioning systems

Cluster 2: Cooling

- IP 113: Information paper on EN 15243 – Ventilation for buildings – Calculation of room temperature and of load and energy for buildings with room conditioning systems

Cluster 3: Indoor environment

- IP 114: Information paper on 15251 – Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor quality, thermal environment, lighting and acoustics

Topic: Inspection of Systems for Heating, Air Conditioning and Ventilation

- IP 109: Information paper on EN 15378 Heating systems in buildings – Inspection of boilers and heating systems
- IP 115: Inspection of air conditioning systems – EN 15240 for the application of the EPBD Article 9
- IP 116: Inspection of ventilation systems – EN 15239 for the application of the EPBD
**Booklets**
The Information Papers introducing the CEN standards are compiled in a series of booklets consisting of the following volumes, each representing a specific subsector in energy performance of buildings:

Booklet 1: Overall Energy Performance of Buildings *(see ref 4)*
Booklet 2: Building Energy Performance *(see ref 5)*
Booklet 3: Heating Systems and Domestic Hot Water *(see ref 6)*
Booklet 4: Ventilation and Cooling Systems *(see ref 7)*
Booklet 5: Inspection of Systems for Heating, Air Conditioning and Ventilation *(see ref 8)*

All these documents and more information, like a database with frequently asked questions, are separately available on the CENSE website:  [http://www.iee-cense.eu/](http://www.iee-cense.eu/)

**3.3.2 Dissemination of information on the CEN-EPBD standards**
In order to disseminate information on the CEN-EPBD standards and the use of it a large series of workshops, conferences and seminars are organised. These events were also used to gather information about the use of CEN standards in the various member states.

Here an overview of the organised CENSE events.

<table>
<thead>
<tr>
<th>Event</th>
<th>Action</th>
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<tbody>
<tr>
<td>IAQVEC2007, 30 October, 2007 in Sendai, Japan</td>
<td>Workshop</td>
</tr>
<tr>
<td>Workshop at IndoorAir2008, 17-22 August 2008 in Copenhagen</td>
<td>Workshop with ThermCo</td>
</tr>
<tr>
<td>Workshop at the 49th CEN/TC 228/WG4 meeting, 18 September 2008 in Copenhagen</td>
<td>Workshop</td>
</tr>
<tr>
<td>Romania Conference, 16-17 October 2008 in Sinaia, Romania</td>
<td>Conference + Workshop</td>
</tr>
<tr>
<td>Prague Conference, 1 December 2008 in Prague, Czech Republic</td>
<td>Conference</td>
</tr>
<tr>
<td>CENSE-ASIEPI Workshop, 18 Feb. 2009 in Stuttgart, Germany</td>
<td>Workshop</td>
</tr>
<tr>
<td>CEN TC 89, 10-11 March 2009 in Brugge, Belgium</td>
<td>CENSE/ASIEPI Workshop</td>
</tr>
<tr>
<td>ClimaMed, 16 April 2008, in Lisboa, Portugal</td>
<td>Workshop</td>
</tr>
</tbody>
</table>
Three main events are highlighted for a detailed description including a summary of the evaluation results. See paragraph 3.4.

### 3.3.3 Collecting feedback from the stakeholders

One of the important activities of the CENSE project was to collect feedback information about the implementation and use of the CEN standards in the various EU Member States.

**General questionnaire on the practical use of the CEN standards**

As a ‘first step’ in the feedback from the MS a general questionnaire was organised on the practical use of the CEN standards.
The main results are given in the Information Paper P90 and in the report (see ref 9).

Some preliminary conclusions from this first general overview:

National laws and/or building regulations should preferably refer to CEN standards, with national annexes for national choices, conditions and input data. CEN rules state that after a transition period conflicting standards from national member bodies (AFNOR, DIN, NEN and others) will have to be withdrawn. However, instead of national annexes many Member States intend to copy into or refer to parts of the CEN standards in national standards or in their laws and/or building regulations. One of the next steps in CENSE will be to investigate, for each group of CEN-EPBD standards, what are the barriers to their adoption in national annexes. This could lead to the development of guidance documents on this aspect and/or to recommendations for improvement of the CEN standards.

It is clear that most Member States are very willing to take the CEN standards into account in one way or another, but perhaps not yet and perhaps not all at once.

Three examples of practical application mentioned in Information Paper P090:

In The Netherlands a new version of the national standard for calculating the energy performance of buildings is in preparation, NEN 7120, integrating and replacing the existing national standards for new residential and non-residential buildings (NEN 5128 and NEN 2916; in force since 1995 and already based on the same principles as EN 832, EN ISO 13790), plus the current national documents for the energy label for existing residential and non-residential buildings (ISSO 82, ISSO 75) and at the same time incorporating as much as possible from the CEN standards.

The new national standard will comprise most of the calculation procedures in one standard, starting with the specification of the building boundaries and partitioning of the building in calculation zones and building functions (e.g. office, sports, ..) up until and including the presentation of the final results for delivered and produced energy, conversion to primary energy and conversion to a numerical indicator and EP classes. Only the calculation of thermal transmission properties and (probably) also the calculation of the air infiltration and ventilation is given in separate national standards (NEN 1068, NVN 8088). In turn, NEN 1068 covers the content of most of the EN ISO standards on thermal transmission. NVN 8088 intends to apply the "national statistical option" allowed for in EN 15242.

NEN 7120 will use the common symbols and (English) subscripts that are given in the so called "Umbrella document" (EN TR 15615), the common definitions (translated) from the same document and the general structure from EN 15603 (see chapter 9). This will support further harmonisation in the near future.

In Germany, a new national standard for calculating the energy performance of buildings was introduced in 2005, the DIN V 18599. It is mandatory in the case of non-residential buildings and will replace the existing national standards for new and existing residential buildings (DIN V 4108-6 and 4701-10), and will incorporate at the same time as much as possible from the content of CEN standards.

The national standard includes all the calculation procedures in one standard, starting with the specification of the building boundaries and partitioning of the building in calculation zones and building functions (e.g. office, sports, ..). The efficiency of the building service systems (accounting for the interaction of system behaviour with building use via the holistic calculation
approach) is also included. Finally the presentation of the final results for delivered and produced energy is regulated, as well as conversion to primary energy.

DIN V 18599 used as far as possible the common symbols and (English) subscripts that are given in the so called "Umbrella document" (EN TR 15615), as well as the common definitions (translated) from the same document. It also conforms to the general structure of EN 15603. This will support further harmonisation in the near future.

Implementation of EN standards in Italy started in 2003. CTI issued a "Recommendation" (known as "R03/03") which modified the UNI calculation procedure to align it with coming EN standards:

- For the building section, EN 832 and 13790 were already well known and stable, so the recommendation only provided guidance on using these EN standards (example: default calculation hypothesis, where to find climatic data, default U values for old structures, etc.).
- For the heating system section, since there were no published EN standards, some of the draft parts of EN 15316 were translated and copied into the recommendation R03/03.

The revision of the R03/03 was published in May 2008 as UNI-TS 11300 (UNI Technical Specification). UNI TS 11300 gives a complete overview of the energy performance calculation process in a single document and contains:

- A calculation hypothesis (i.e. internal winter/summer internal temperature)
- Reference to EN standards with specification of which method is to be used when alternatives are left open within the EN standard
- Copies of other standards which, at the time of drafting the UNI-TS, were not yet approved and published (example: EN 15316-4-1 about boilers).

The first two parts of UNI-TS 11300 have been published. Building needs for heating, DHW and cooling, plus most common heating systems and domestic hot water systems are covered. Further parts will be developed about renewables, special generation systems (heat pumps, district heating), cooling systems, mostly by referencing published EN standards.

Copied text from EN standards should be removed and replaced by references to EN standards in further revisions of UNI-TS 11300.

Italian national regulation and most regional regulations require that the energy performance of buildings be calculated according to UNI-TS 11300.

Until now, only one Italian region has imposed its own calculation method, which is entirely specified in the regional law.

**Experiences with questionnaires**

Since the response on from the MS and target groups on detailed questionnaires turned out to be very low it was decided during the project to choose for a 2 level approach: (1) send to the respondents firstly an email with a few straightforward questions and (2) –if necessary to be decided by each WP- including an attachment with a detailed questionnaire. This approach resulted in a better response, although in general several reminders were necessary to receive responses, not because of lack of interest or involvement of the contact persons, but due to "questionnaire fatigue".

The results of this approach are laid down in the following Feedback reports. Based hereupon also final recommendations are give for each cluster of standards. Here a brief summary of each report.
EN 15603 - 15217: Feedback report: Definitions of rating and methods

The standards:
EN 15603: Energy performance of buildings - Overall energy use and definition of ratings:
This standard specifies a general framework for:
- the assessment of overall energy use of a building;
- the calculation of overall energy ratings (primary energy, CO2 emissions, energy costs).
The standard collates results from other standards that specify calculation of energy consumption
within a building. It accounts for energy generated in the building, some of which may be
exported for use elsewhere. It presents a summary in tabular form of the overall energy use of the
building and defines the uses of energy to be taken into account for setting energy performance
ratings for new and existing buildings.

and for energy certification of buildings”:
This is the standard that clarifies the different possible approaches for certification.
This standard defines:
- Global indicators to express the energy performance of whole buildings, including heating,
ventilation, air conditioning, domestic hot water and lighting systems. This includes the different
possible indicators as well as a method to normalize them.
- Ways to express energy requirements for the design of new buildings or renovation of existing
buildings.
- Procedures to define reference values and benchmark.
- Ways to design energy certification schemes.
The choice of the relevant options must be made by each Member State.

The evaluation of the questionnaire responses:
In general, the respondents confirm the need for the standards EN 15603 and EN 15217 for the
building regulations in the Member States of the EU.
These standards cover all relevant issues, they are detailed and concrete enough.
The majority of respondents is also satisfied with the number of normative options given in these
standards.
The majority of the respondents wants no major changes in these standards. No additional
guidance or background information is needed either.
A main operational obstacle is the timing of the preparation of the CEN standards which did not
coincide with the timing decided at national level.
And although the structure of the standards EN 15603 and EN 15217 is clear and understandable
the majority of respondents expressed the need for a compact method at national level which had
as consequence that only selected parts of the CEN standards were integrated in the national
methods.

Finally the following conclusions can be drawn from the questionnaires:

We need a restructuring of the standards, leading to a clear separation between the obligatory
common procedures in the standards and the options to be chosen at national level. Also, to
remove informative annexes to separate Technical Report(s).
- This will make it easier to adopt at national/regional level the CEN standards as they are,
translated in national/regional language if necessary.
- This will also make it easier for the writers of the methods for the national/regional building regulation to follow actively the preparation of the CEN standards, to exchange knowledge and experience with colleagues in other countries and to anticipate on the CEN standards when writing or revising the procedures at national/regional level.

The national procedures could then formally consist of the CEN standards plus short national annexes (containing national choices and input data). To accommodate the need for a compact national method, a (e.g. informative) national application document could be envisaged that integrates the contents of the CEN standards with the national choices and input data.

Additional feedback from workshops
In the course of the project several workshops were organised, focussing on discussions to additionally receive feedback 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 standards and its implementation.

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 15603 and/or EN 15217 and related 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 Annex A taking into account that general conclusions and recommendations are already provided in the CENSE document providing general recommendations on the whole set of CEN-EPBD standards.

Specific additional conclusions:
- The first priority seems to be to promote the common modular structure of EN 15603 to be used in all Member States and to work out in more detail the hierarchy in and links between the modular elements. In this respect, there is a strong need to develop a common position on the level of detailedness of the calculation procedures, such as the calculation time step (monthly, hourly, ..) and the complexity of the calculation procedures. Typically, the choice depends on the application and specific boundary conditions.

- A common understanding on the relation with the applications and the boundary conditions is necessary in order to be able to prepare a consistent set of standards that will fulfill the needs from the Member States and other interested parties. In this respect it is also noted that the application range is wide: from a simple heated dwelling to very complex non-residential buildings; from an old building with very little information on the component and system properties to new highly energy efficient buildings.

    ➔ The development of a common position on these issues should be one of the highest priorities in the development of the second generation of CEN standards for the EPBD, which by its nature should precede the discussion of the revision of the individual standards.

- Another concern is that the MS don’t want to be confronted with substantive changes in the calculation procedures which will jeopardize the continuity in the instrumentation implemented at national level.
It is important to bring in from the start a maximum of clarity on the goals, the basic principles and the overall structure, and to involve the MS in the process.

- More specific observations and recommendations related to the level of complexity of the methods and the link with software tools are presented in the relevant sections of this report.

**EN-ISO 13790: Feedback report on Calculation of Energy use**

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

The main results of the questionnaires are the following:

- From all responding countries the national building regulations do ask for a kind of procedure as laid down in EN ISO 13790 and consequently this standard is very relevant for them.
- In none of the responding countries EN ISO 13790:2008 is used directly, but in all responding countries indirectly, by copying parts of it in their national standards or building codes.
- There is no operational obstacle to put this specific CEN standard in force by the national/regional regulations. But the timing of the preparation of CEN standards did not coincide with the timing decided at national level (from project plan to implementation in the law and application in practice).
- It is true that it already requires a lot of time and energy to agree nationally upon the national method, thus adding a CEN circuit would only mean more time and effort and added risk that the procedures are not available in time or do not describe what is nationally needed. Therefore, a transparent planning of revisions of these CEN standards (when and what) would be helpful. It would also help if people involved in the national or regional building regulations become involved in the CEN standardization activities.
- All respondents declare the structure of the standard EN ISO 13790 clear and understandable. But the standard contains many choices to be made or to be worked out with more detail at national level.
- The standard covers all relevant issues; it does not need to contain a more concrete method or to provide more normative options to choose or to be more detailed or less detailed.
Opinions are divided if the number of options to choose from should be reduced: withdrawing them would cause problems to specific countries where several of the options are used.

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

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

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

The awareness of calculation methods covering passive issues can be rated alright but with a noticeable potential of improvement, as some countries’ participants indicate a low awareness focussed on 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.

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

Review of the standard’s structure:

- A clear structure, which separates common procedures and national choices, is essential to make the document fit for use as normative document and to enable the introduction of a brief and transparant (normative) National Annex that comprises the national choices, boundary conditions and input data. The National Annex thus controls the national (or regional) application of the standard. Regarding this issue, a common structure of all CEN-standards should be aimed at.

- The need for a compact national document can be accomodated by an (informative) national Application Document that has the same content as the (normative) CEN standard plus (normative) National Annex, but re-edited, integrating the common and national elements.

- The obstacle formed by the big volume of informative annexes for national implementation (translation, conversion, status) can be removed by moving all informative annexes to a separate Technical Report, accompanying the standard.
The link with other standards can be made more explicitly clear by introducing flow charts and overviews of input and output variables.

A spreadsheet with worked examples should be available together with the standard, for testing, benchmarking and validation.

- Technical extensions or improvements of the standard’s methodology, covering e.g. the following issues:
  - General:
    - More explanations on partitioning the building into calculation zones.
    - Extra natural or mechanical ventilation for cooling and solar shading controlled on outdoor or indoor climate.
    - Check intermittency correction factors for the monthly method (and link with validation according to EN 15265); check extra radiation to the sky.
    - Add simple procedure to account for the effect of spatial levelling of internal temperature in dwellings, as function of specific heat losses.
    - Add double envelope and interactive façades.
    - Add principles on to what level of detail it still makes sense to introduce correction factors in a simplified monthly method, as opposed to changing over to a (simple or more detailed) hourly method.
    - Add list of details that need to be harmonized to ensure reproducibility for detailed methods.
  - Passive Heating and Cooling (to increase awareness and successful use of passive systems):
    - Include and explicitly cover aspects and systems for passive heating and cooling in the calculation methodology, for example double skin facades and ground-coupled heat exchanger (earth tubes)
    - Support the clear display of passive contributions on Energy Performance Certificates
  - Development of performance characteristic values of building elements, including the contribution of passive heating, cooling and daylighting, to support the energy labelling directive (e.g. windows)
  - Consideration of results from additional relevant research projects, for example of further IEE-projects.
    Regarding double skin facades the IEE-project “BestFacade” provides an appropriate calculation procedure as well as an information database, a design guide and default values. Whereas within “ENPER EXIST”, special needs for the assessment of existing buildings were investigated.
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 the report (ref 12).

Feedback report of the series of EN ISO standards on thermal transmission

This report concerns the feedback on the series of international standards for calculating the thermal performance of building components and building elements (EN ISO 6946, 10077, 10211, 10456, 13370, 13786, 13789, 14683; EN 13947).

The questionnaire is designed as a simplified questionnaire, as email, which contains a few questions and could be answered within a couple of minutes. The evaluation of the questionnaire should provide information on future efforts to make the standards better known and accepted and on necessary contents for revising the standards in order to allow a broad application in daily design practice. Because of the limited time remaining available for the preparation and follow up on this questionnaire until the end of the project, the questionnaire was sent out only to specific known contact persons in 10 countries, as these personal contacts would make it likely to receive response at short notice without excessive persuasion. From representatives of 7 EU Member States a completed questionnaire was returned, plus one less detailed preliminary response. Despite the limited number, the available responses were significant enough to indicate some trends.

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

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

The two main reasons mentioned for not (directly) using this subseries of EN-ISO standards in the national building regulations are: the tradition of having national standards in this area and the advantages of an all-in-one document (as one country describes): a coherent and accurate document prepared by a well-organised group of national experts, which includes all national choices and input data.
The questionnaire did not address technical details. Only concerning the strongly revised EN ISO 13370, (calculation of the heat transfer via the ground) the respondents were asked about their experiences. There, it seems that the specific question on new procedures to calculate the heat transfer via the ground came a bit too early, because these new procedures are not yet implemented widely. One point of attention seems to be the quantification of the impact of linear thermal bridges in the foundation. Because in several countries, the linear thermal transmittance values are given in a so called "thermal bridge atlas", the validity of this element in the new procedures in EN ISO 13370 is a point of attention. It is also clear that harmonization simply takes time…. but with a good set of conditions the process can be significantly accelerated.

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

- A clear structure, which separates common procedures and national choices, is essential to make the EN ISO standards fit for use as normative document and to enable the introduction of brief and transparent (normative) National Annexes that comprises the national choices, boundary conditions and input data. The National Annexes thus control the national (or regional) application of the standards. Regarding this issue, a common structure of all CEN-standards should be aimed at.

- The need for a compact national document can be accommodated by an (informative) national Application Document that has the same content as the (normative) CEN standard plus (normative) National Annex(es), but re-edited, integrating the common and national elements.

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

EN 15193: Feedback report on Lighting
The development of the European CEN standard EN 15193 [1] on lighting energy can be regarded as a big step forward concerning the implementation of energy efficient lighting concepts. It offers a useful umbrella framework of different methods and ways to determine lighting energy needs. Nevertheless, the feedback from a European inquiry process within the CENSE-project (questionnaire and workshops) on acceptance and applicability of the standard suggests that further improvements should be considered within the next review phase of the standard. Editorial and structural clarifications should be tackled as well as some technical aspects, which have not yet been addressed sufficiently.

The 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, including lighting, according to the EPBD. The project’s goal is to identify problems concerning the standards’ contents and their implementation via questionnaires and workshops and to formulate recommendations for improvement.
Within the framework of the CENSE-project the standard EN 15193, covering the energy requirements for lighting, was investigated. The questionnaire’s evaluation shows that though lighting requirements have been defined in most European countries, only few countries did actually put the CEN standard into force; also, awareness of practitioners is still low.

In general, the standard is regarded as a useful umbrella document and its methods are considered to be applicable and helpful. Nevertheless, parts of the standard are rated being not easy to understand. Although many essential parameters in the determination of lighting energy needs are covered, some additional aspects should be addressed in a revised version. Providing, for instance, methods to rate lighting controls in more detail, to determine the installed power of new lighting installations and to rate the impact of sunshading devices on the lighting energy demand might help to further improve the standard’s quality and acceptance.

A simple means to raise acceptance seems to lie in a review focusing on structure and editing in order to clarify and simplify parts of the document. Particularly the presentation of equations should be reorganized, for instance by adding a list of the variables used to each equation and by describing connections to other equations, making them more understandable. An example of technical aspects still to be addressed is artificial lighting, which is only taken care of in existing buildings in the current version of the standard. Consequently, an additional approach covering the lighting design in new buildings needs to be developed, and a simplified method should be included. Also the effect of lighting controls should be considered in the calculation method as well as the impact of glare and sunshading protection on lighting energy demand.

By providing extra material with simplified explanations and background information, the readers' ability to understand and apply the standard could be further enhanced as well as their awareness of the methods underlying available computer software.

In consequence of the above results obtained by the inquiries made, the following recommendations for a review of CEN standard EN 15193 are given:

- **Review of the standard’s structure and editing of the equations.**
  - A clear structure, which separates common procedures and national choices, is essential to make the document easily understandable. Regarding this issue, a common structure of all CEN-standards should be aimed at.
  - The current layout of the standard with numerous stand-alone equations and with a lot of detailed information in the annexes requires a lot of going back and forth in the document when applying the methodology. Especially the editing of equations is crucial. They should be fully spelled out, using common symbols, terms and definitions and be followed by a list of variables used. Input/Output-links between equations should also be provided.
  - The reduction of typing errors should be a positive side effect of the review process.

- **Technical extensions of the standard’s methodology, covering the following issues:**
  - A simplified method to rate the installed power of new buildings in the design phase. In its current version, the standard focuses on the installed power in existing buildings only.
A method to rate the energy impact of sunshading systems, especially of moveable devices. In Annex B a detailed method is suggested.

A more distinguished scheme for daylight-responsive controls of artificial lighting. Annex C contains an applicable method.

Additional representative climatic data, especially for climates of the Northern latitudes.

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

- Control and revision of the benchmark values.

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

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

EN 15316 – 15378 -15459: Feedback report on Heating and Domestic Hot Water Appliances
The aim of this report is to establish a list of recommendations which might be useful for the revision of the CEN standards.

These recommendations result from the experiences of CENSE Partners about the existing set of CEN standards and from the knowledge delivered by the feedbacks of the Members States through their answers to enquiries and questionnaires, in particular:

- Enquiry among participants of a software workshop related to EPBD
- Questionnaires sent out to Member State contacts involved in national building regulations.

This feedback, supplemented with personal (national) experience of the experts involved in the CENSE project, was used to make a set of recommendations to improve the current set of CEN standards.

These improvements aim at a better (direct) implementation of the standards in the Member States, through

- an improved and harmonized structure,
- connecting loose ends
- adding additional components to the set of standards.

- Improve the structure of the standards
  - A clearer, better understandable structure.
This should be done by making a clear distinction between input, algorithms (formulas) and output, and also between the normative method and the data and choices in national annexes. The links between in- and output of different standards have to be explicit. Below is a graphical representation:

- **A reduction of options/methods.**
  Where possible the number of methods in the standards should be reduced. In some cases more than one option is necessary to make a method applicable in all situations or countries. The different options in the standards should be critically reviewed to see where options can be removed or integrated with other options.

- **More unambiguous standards.**
  The standards should be software proof (e.g. Excel sheet related to each standard). There should be no room for “interpreting” a standard. In the future, the main readers of the standards will be the software houses. Standards should not longer have a text book character. The calculation standards should be structured by: input data, flow chart, algorithm, output data.

- **Overview of required input + reference to input source.**

- **Possibility for simplified input – less detailed methods**
  Feedback on the standards consistently asks for less detailed standards. However, the real question doesn’t seem to be the need for simplified methods. The standards will not be applied “by hand”, but by using a software tool, so complex methods do not affect the end user.
  The real question is for more simplified input options. Especially for existing buildings, not all input parameters can easily be achieved. The input parameters could be simplified by adding default values, which can be used if input variables are unknown.
  On the other hand, the time and effort needed to agree upon the details of such detailed methods in the standards should not be underestimated.
• **Add standards and add content**
  - New standard on **operating conditions** of generators (e.g. water temperature, source conditions, etc.) and **multi-generators** (different types of generators operating in the same zone);
  - Information on how to treat generators providing **heating and cooling simultaneously**;
  - More explicit treatment of **air heating systems** like **air-to-air heat pumps**;
  - Add shower heat recovery units;
  - **EN 15316-1:**
    - General structure to illustrate links between standards;
    - Overall formulas, linking to the other EN 15316 standards;
    - Correction for energy loss due to **simultaneous heating and cooling** (more interaction heating and cooling standards where necessary);

• **Uniform definitions – common building and system descriptions**
  Uniform input, output, terms, symbols and building description for the standards is needed to enable software manufactures to make a common software package for standards. Furthermore, the same building description and set of input, output, terms and symbols can be used for design tools.

• **More links between Inspection and certification**
  Energy performance of building is starting with design and finishing with building operation. Most of these steps are dealt with in the EPBD (holistic approach). The interactions between these actions should be reflected also in the related standards. For example it should be shown how the information of inspection could be linked and used for certification.

• **Take into account dynamic calculations, based on hourly steps, in the standards**
  The energy calculations are still mostly under steady state conditions with a monthly calculation step. This calculation does not take into account correctly:
  - The interactions (e.g. envelope, systems) especially in low energy houses;
  - The performance of modern systems (e.g. heat pumps).

  As in most cases the calculation is made by computer tools, if needed, the simplification should not be on the calculation method but on the input data.

• **Work out standards for measured energy used in building inspection and building certification**
  A part of the inspection of buildings and systems could be actual measurement of energy. This could be used to evaluate real energy performance. An important factor in this respect is user behaviour. A measurement methodology (complementary to what is described in EN 15603 on this subject, focussing on the systems) should describe how real energy use can be measured and what factors may influence the energy use.
This way the inspection standard could act as a tool for improvement of the energy efficiency of buildings, systems and users. Measured energy rating (operational rating) could be an alternative to calculated energy rating where the influence of the user behaviour is less individual (e.g. office buildings, schools).

- **More commitment**
  In the feedback from national experts on national building regulations, the absence of national experts on the European level was mentioned as a principal obstacle for the implementation of CEN standards at a national level. Solutions should be proposed to make national experts more closely involved in the development of a new set of standards. Elements like a transparent time plan, an overall set of basic principles and a common format for the standards and the national annexes will make this easier.

**EN 15241 – 15242 – 13779: Feedback report on HVAC**

The aim of this report is to establish a list of recommendations which might be useful for the revision of the CEN standards concerning heating, ventilation and airco systems (EN 15241 – 15242 – 13779).

Two questionnaires have been sent to Members States:
- one specific enquiry before the workshop in Brussels (June 29th, 2009) (see annex A),
- a short questionnaire to Denmark, France, England, Italy, Czech Republic.

The answers confirm the interest on ventilation, inspections and indoor air quality for buildings regulation in Member States but also, some points to recast and to update. These standards are judged covering all relevant issues but not sufficiently detailed and concrete to be implemented on software. Series of recommendations are listed below.

Conclusions and recommendations for the standard on room conditioning systems EN 15243 are:

- Development of methods to determine cold distribution efficiency: the standard does not provide concrete calculation methods for annual cold distribution efficiency. This is due to the variety of systems, the complex nature of interaction between heat and cold distribution and the lack of (national) methods on this subject.

- Asses the Eurovent guidelines on their usefulness to determine cold generation efficiency: the standard does not provide concrete calculation methods for annual cold generation efficiency. This is due to the variety of generators and systems and the lack of (international) standards on testing cooling machines and systems. However in recent years Eurovent has published test guidelines for several systems.

Conclusions and recommendations for standards on inspections are:

- Avoid regarding inspections as an isolated issue but as an integral part of the whole “EP package”: there is a need to build up the "big picture" of inspections, including also links to the other elements of the EPBD (EP requirements and calculations, Certificates), and including clear definitions of "air conditioning systems". The basic definition should include
a list of functions, allowing a few different interpretations of the scope but strictly within a common framework.

Conclusions and recommendations for standards on ventilation are:

- Development of multi-criteria approach: In EN 15242, ventilation was taken from the hygienic point of view. In low energy building, ventilation will be also an important factor for energy and comfort.

- Connection of EN15241 and EN 15232: control systems will have an important position in the future. In EN 15241, a connection should be made with control standard EN 15232

Concerning the general issues, we might recommend that the next set of standards should have a new template:

- Nomenclature : to present all parameters and unities
- Description of the technique and physic models: natural ventilation, balanced systems,
- Providing examples in annexes
- Flowchart: to present the calculation model and to facilitate the implementation on software.
- To increase the adoption of these standards, an Excel sheet must be proposed.

### 3.3.4 Recommendations for the 2nd generation of CENSE standards

**Introduction**

The current CEN(-ISO) standards to support the EPBD present possible methodologies, which makes direct implementation on a national level nearly impossible. A Member State can only develop a calculation procedure based on the EN standard method of choice. This results in large differences in the final energy performance of buildings calculation procedures across countries. What is needed is a second generation which presents calculation procedures with a clear indication of what values or procedures should be given in National Annexes. This has to promote direct use of the standards resulting in European uniformity.

The following paragraphs contain concrete recommendations in this direction.

**Main recommendation 1:** Develop a common structure for each standard, with a clear separation of common procedures in the main document and national choices in form of an annex. With a special format for the specification of the national choices.

As shown above, the procedures to assess the energy performance of buildings should be unambiguous, but also allow handling national differences. The current CEN and EN-ISO standards for the assessment of the energy performance of buildings typically contain an
entangled mix of common procedure and national choices, as shown in the following example (fig 3.4).

Example:

Fig. 3.4 – Example of unwanted entangled mix of common procedures and national choices as found in many of the CEN-(ISO)-EPBD standards. This example is from EN 15603

As several EU Member States implemented the 1st generation CEN-(ISO)-EPBD standards "in a practical way", specific parts are copied in the national or regional method, either a national standard or another national document that is part of the national or regional building regulations. The CEN-(ISO)-EPBD standards are not directly implemented and it is very difficult to find out which parts of it are implemented at national/regional levels. In several countries selections from the main content of EN-ISO 13790:2008 are used in the national method, but re-edited and mixed with national choices, boundary conditions and input data:
**Solution:** Develop a common structure for each standard, with a clear separation of common procedures in the main document and national choices and input data in the form of easily accessible and comparable national annexes (fig. 3.6a). With a special format for the specification of the national choices (example: fig.3.7). And by publishing the collection of national annexes as a separate part of the standard, at more regular intervals, these can be kept up to date more easily (fig. 3.6d).

**Illustration: harmonised procedures vs national choices**

- National choices and data can be given in a short and transparent National Annex to the EN-ISO standard.
- Example: Country X: Option A: Mandatory, Option B: Optional. Climate data: in Nat.standard X, Table input data: ...

**Illustration: for country or region X**

- At national/regional level, “country X”:
  - The EN or EN-ISO Standard
  - Option A
  - Option B
  - Format for providing national choices and input data
  - The National Annex to the EN or EN-ISO standard
- Example: Country X: National Annex to the EN or EN-ISO standard
  - Option A
  - Option B
  - Format for providing national choices and input data
- At national/regional level: “country X” = The EN or EN-ISO Standard

**Illustration: at EN or EN-ISO level**

- For a given EN or EN-ISO standard:
  - Collection of National Annexes
  - The EN or EN-ISO Standard
  - Option A
  - Option B
  - Format for providing national choices and input data
- The National Annex for country N
  - Enables transparent (tabulated) overview of similarities and differences between countries

**To avoid problems due to phase differences: split (1)**

- "EN(ISO) X - Part 1" = the EN(ISO) standard itself
- "EN(ISO) X - Part 2" = the collection of National Annexes
- EN(ISO) X – Part 1 The actual standard
  - Option A
  - Option B
  - Format for providing national choices and input data
- The National Annex for country X
- Revisions of Part 2 can be published with shorter intervals, if individual National Annexes are changed or added

**Illustration: at European level this will make comparison between countries feasible**

**d) At European level this will make comparison between countries feasible**

**c) At European level this will make comparison between countries feasible**

**Fig. 3.6 – Recommended common structure for 2nd generation of CEN-(ISO)-EPBD standards**

- Revisions of Part 2 can be published with shorter intervals, if individual National Annexes are changed or added

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**Fig. 3.5 – Example: current practical applications of EN ISO 13790 (Energy use for heating and cooling) in different countries**
Advantages:
This will make it possible to use the international standard directly ("plug and play"), with a short and clear national annex that provides the national or regional choices on boundary conditions and input data. These national annexes, in turn, will make an international comparison of methodology and input data more easy and transparent (see fig. 3.6c).
It will facilitate a check if a national or regional procedure is in agreement with the international standard.
It will make both, the use and the future development of the standard, based on inventory of national/regional needs, much more efficient and increase the involvement/commitment of the countries in the development.
Suggested action within or after CENSE: Prepare examples of a possible common structure

In addition, to further facilitate adoption (including translation) at national or regional level:

- It might be considered to move content that only relate to design to specific design support standards.
- It might be considered to move informative annexes to a separate Technical Report (fig 3.7a)

Often, for daily use, there may be a need for a practical national/regional application document in which all elements are integrated. The illustration in fig 3.7b shows a possible way to deal with this.

To minimize threshold for implementation at national level: split (2)!

To avoid content which only relates to design to design support standards.

What about need for national “all-in-one” documents?

a) Move all informative parts and informative annexes to an accompanying Technical Report; and make specific sections obligatory: internal validation test results, worked example,..

b) At national level an "all-in-one" document, for daily practice, can be constructed from the CEN(-ISO) standards plus national annexes

Fig. 3.7 – A possibility to match need for common procedures and need for national choices

For daily practice: National (informative) Application Document on (set of) EN(-ISO) standard(s)

Same content (?!)

but re-edited: only national options and data

Fig. 3.7 – A possibility to match need for common procedures and need for national choices
Possible improvement: add tabulated overview of the choices to be made at national level

Main recommendation 2: Unambiguous and validated sets of equations
Spell out all equations and provide all I/O links between equations; add a spreadsheet with worked example(s)

Background: Various standards provide details of the required calculations, but the overall equations and the links (input-output) between the equations are missing.

Problem: Consequently, the equations have to be worked out at national or regional level. This unnecessarily hinders the direct use of these international standards at national or regional level. It hinders a check if national or regional procedure is in agreement with the EN (EN-ISO) standard. It hinders the validation of the procedures and the preparation of software.

Solution: Spell out all equations and provide all I/O links between equations. In addition: each calculation procedure should be accompanied with a spreadsheet with worked examples, to validate the relations (input → calculation → output) and to facilitate the application and software preparation.

Advantages: This will remove one grave obstacle against the direct use of the international standards at national or regional level. It will make it possible to validate the procedures at international level and to prepare (common) software.

Example: The following example shows a fully spelled out equation, with unambiguous references and (S.I.) units for each variable (fig. 3.9).
Main recommendation 3: Use common symbols, terms and definitions
Use set of common symbols, terms and definitions in all CEN-(ISO)-EPBD standards on energy performance of buildings

Background: A set of common symbols, terms and definitions is available and already in many of the CEN standards to support the EPBD, including some EN-ISO standards, such as EN ISO 13790:2008, but not yet in all standards that are used as basis for a second generation of international standards on the assessment of the energy performance of buildings.

Solution: Use the set of common symbols, terms and definitions for all CEN-(ISO) standards in the whole set of standards on the energy performance of buildings. And strongly recommend that the same set is also used in national/regional application documents, even in other languages.
Good examples:

Main recommendation 4: Rationalisation of the number of options given in the standards

Problem: The current set of CEN(-ISO) standards often offer several options to choose at national or regional level, depending for example on the local climate, culture and application. Moreover, the EU Member States expect sufficient accuracy of the procedures in order to obtain realistic energy figures, also in case of buildings with complex e.g. dynamic technologies, but no overcomplication. At the same time they expect that the procedures are robust, reproducible and usable in practice, also in case of limited availability of input data, e.g. in old existing buildings. This requires that the procedures still enable a choice between different options, but these options need to be rationalized, each option intended for a specific application.

Solution: The procedures have to enable a choice between different options, but these options need to be rationalized, each option intended for a specific application. This would be facilitated by the main recommendations 1 and 5. Also important is that inputs and outputs match between options, to avoid input-output mismatch between different options from different standards. A balance is needed to avoid that harmonization hinders countries to respond promptly to new local developments.

Main recommendation 5: Prepare a systematic, clear and comprehensive overall, continuous but modular structure

Problem: The current set of standards had to be developed in a very short time, with no possibility to develop a clear program of requirements in collaboration with the Member States.

Solution: In combination with the previous main recommendations: The preparation of a continuous but modular overall structure, covering all items related to the energy performance of buildings, providing the overall framework which will enable a step-by-step implementation by the EU Member States. For instance, by preparing a basic standard on the integrated energy performance of buildings, re-using the main elements of EN 15603 (Overall energy use and definition of energy rating) and core elements of other key standards, including common definitions, terms and symbols, offering a systematic, clear and comprehensive continuous but modular structure, enabling a step-by-step implementation by the Member States, taking also into account the nature of each procedure identifying the typical type of user.
Preparing and applying a systematic hierarchic numbering of the standards of the set could be an additional asset.

**Consistency for standards that provide input data and boundary conditions**

Standards that provide input data or the procedures on boundary conditions for the assessment of the energy performance of buildings (segment 7 of the pyramid shown in figure 3.1) need to provide information that is consistent and useable for the higher levels in the pyramid.

**Recommended actions:**

- These standards need to be identified as such (existing ISO or CEN standards and work items, need for new ISO work items)

- It has to be checked if the output fits as input for the energy performance assessment:
  
  o The output variables should be (made) consistent with respect to common terms, definitions and symbols.

  o Type of output needed: Fit for use in annual calculations, monthly calculations, hourly calculations (e.g. parameters determining the efficiency of a combustion boiler; thermal transmission through the ground floor to the ground, total solar energy transmittance of a window with solar shading device, ...).

  o Application range (e.g. types of buildings, new/existing buildings/systems).

  o Fit for use in context of building regulations (unambiguous, practical, …).

On the other hand: To enable the use of the standards in situations with different levels of available details of input data (detailed versus default values), the "segment 7" standards writers need to be informed how big or small the impact of uncertainties or inaccuracies in the component data is on the energy performance of the building. Only then they can offer procedures with options that are the best suited (a) for situations with detailed information, like new building designs, and (b) for situations with little or inaccessible information (e.g. old existing buildings).

**Consistency with related areas**

Another challenge is to establish efficient links to related areas, such as monitoring and inspection of energy performance and commissioning of systems, design of energy efficient buildings, validation of energy calculation methods, environmental impact of buildings and energy management.

Areas of standardization which are closely related to the energy performance of buildings are:

- Presentation of measured energy use of buildings: existing work item of ISO/TC 163/WG 3

- Monitoring and inspection of energy performance: new work items to be identified by AHG of ISO/TC 163

- Commissioning
• Design of energy efficient buildings
• Environmental impact
• Energy management
• Validation criteria for energy calculation methods (including energy needs and technical building systems)

Recommended actions: Prepare overview, establish links, prepare proposals to ensure consistency.

CEN-ISO collaboration
The timing of periodic revision of the CEN standards (typically 5 years after the publication) coincides well with the intended publication date of ISO standards on energy performance of buildings (typically 2 to 3 years from now), as figure 7.8 shows. There is also a strong interest of ISO in the subject, which culminated in the recent (June 2009) establishment of a Joint Working Group in ISO to develop ISO (EN ISO) standards on energy performance of buildings, using the EPBD - CEN standards as a basis. This creates a unique opportunity for Europe to retain the lead on the preparation of energy performance standards in a combined CEN-ISO effort.

![Fig. 3.11 – CEN, CENSE and ISO timing](image-url)
Parallel routes for references to CEN or ISO standards

**Problem:** The development of EN ISO standards requires that for use within CEN (to be in compliance with European Directives, such as Construction Product Directive or EPBD) normative references have to be made to CEN standards (if no EN ISO standard exists). But for use elsewhere, references have to be made to ISO or national standards.

**Solution:** Following extensive consultations within ISO, for EN ISO 13790, one of the key standards on the energy performance of buildings, this problem was solved by concentrating all references to other standards in one normative annex (Annex A) which provides for the "CEN area": references to CEN (EN or EN ISO) standards and for "elsewhere": references to ISO standards or, in absence of ISO standards, to national standards.

Of course, other columns, for other international regions, could be added if applicable. In the working draft standards currently being prepared in the JWG this solution is already adopted.

*Example from EN ISO 13790:*

![Fig. 3.12 Example of "Annex A" for parallel routes in normative references](image)

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**Annex A**

(normative)

Parallel routes in normative references

This international standard contains specific parallel routes in referencing other international standards in order to take into account existing national and/or regional regulations and/or legal environments or maintaining global relevance.

The standards that shall be used as called for in the successive clauses are given in Table A.1.

<table>
<thead>
<tr>
<th>Clause</th>
<th>Subject</th>
<th>CEN area</th>
<th>Elsewhere</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Energy balance of technical building systems</td>
<td>Heating: EN 15198-2.1, 2.2</td>
<td>National standards or other appropriate documents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ventilation: EN 15261</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cooling: EN 15244</td>
<td></td>
</tr>
<tr>
<td>6.1</td>
<td>Energy performance rating</td>
<td>EN 15207</td>
<td>National standards or other appropriate documents</td>
</tr>
<tr>
<td>6.3</td>
<td>Influence of system boundaries on zoning rules</td>
<td>Heating: EN 15198-2.1, 2.2</td>
<td>National standards or other appropriate documents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ventilation: EN 15261</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cooling: EN 15244</td>
<td></td>
</tr>
<tr>
<td>7.2.3</td>
<td>Variation of detailed simulation methods</td>
<td>EN 15208</td>
<td>National standards or other appropriate documents</td>
</tr>
<tr>
<td>8.3.2</td>
<td>Thermal transmittance:</td>
<td>EN 10264</td>
<td>National standards or other appropriate documents</td>
</tr>
<tr>
<td></td>
<td>— curtain walls</td>
<td>EN 10264-9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>— clerestory</td>
<td>ISO 10277-2</td>
<td>ISO 10277-2</td>
</tr>
<tr>
<td></td>
<td>— window frames</td>
<td>ISO 10277-1</td>
<td>ISO 10277-1</td>
</tr>
<tr>
<td></td>
<td>— wall window or door</td>
<td>Overall heat transfer by thermal transmittance: ISO 10383-9</td>
<td>Overall heat transfer I thermal transmittance: ISO 10383-9</td>
</tr>
<tr>
<td>8.3.1.3</td>
<td>Ventilation air flow time factors and supply ventilations of air infiltration, intake ventilation and out mechanical ventilation</td>
<td>EN 15242 and/or EN 15261</td>
<td>National standards or other appropriate documents</td>
</tr>
</tbody>
</table>

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CENSE Final Publishable Report, final version, July 1, 2010
3.4 Technical recommendations for specific (subsets of) standards

Per cluster of standards on a specific subject technical recommendations have been prepared by the CENSE teams who focused on a specific subset of the CEN-EPBD standards. These recommendations are based on a combination of questionnaires and specific workshop sessions.

These technical recommendations can be found in the following reports (and available at the CENSE website):

- CENSE WP2.3 N03, Report on the application of two key standards for the EPBD: EN 15603 (Overall energy use and definition of ratings) and EN 15217 (Methods for expressing energy performance and for energy certification of buildings), Kees Arkesteijn en Dick van Dijk, May 2010 (ref 10)
- CENSE WP3.3 N04, Report on the application of the series of EN ISO standards on thermal transmission properties of building components and building envelope. EN ISO 6946, 10077, 10211, 10456, 13370, 13786, 13789, 14683; EN 13947, Dick van Dijk, Anna Staudt and Hans Erhorn, May 2010 (ref 13)
- CENSE WP4.3 N01, Enquiry Analysis of the CEN-standards on Heating Systems and Domestic Hot water. Recommendations, Johann Zirngibl and Claude François, March 2010 (ref 14)
- CENSE WP5.3 N01, Enquiry Analysis of the CEN-standards on Ventilation and Air Conditioning. Recommendations, Hicham Lahmidi, May 2010 (ref 15)

Timing and organization

The following paragraphs give suggestions, and are not intended in whatever way to interfere in the discussion and decisions of CEN and/or ISO, where also other considerations may play an important role.

To ensure consistency and to enable to comment on drafts, including the interactions, the development of international standards on the energy performance of buildings should preferably be developed in a synchronised way: The group of interrelated European and/or International standards can be synchronized by aligning their development and publication stages.

NOTE The concept of ‘package’ applies in CEN but not in ISO, being tied to a group of standards having the same date of withdrawal (of existing national standards on the same topic), because CEN members are bound to adopt the European Standard and to withdraw any national standard in conflict or overlapping. ISO members are not bound to adopt International standards.

Recommended action: Add tentative time schedules.
Communication plan
It is an important job to send clear messages on the work being done and the timeline (“master plan”):

- For policy makers
- For related CEN and ISO initiatives
- For CEN: aim: next generation of CEN-(ISO)-EPBD standards? = all EN ISO standards?
- For national standard writers: they must know when and what they can expect from ISO (EN ISO), to be able to anticipate when they are preparing (revisions of) the national procedures/building regulations

Summary of the recommendations
- A more uniform structure for each of the standards in the package.
  - With a distinction between common procedures and options to be chosen at national level; this will bring more clarity in the adoption of the procedures and the specific choices per country;
  - Fully spelled out equations and unambiguous links between input and output, making the standards ready-to-use for validation and software preparation;
- Use of the available common set of terms, definitions and symbols & subscripts, the latter also for all versions and national application documents in other languages.
- Rationalisation of the number of options given in the standards, each option aiming at specific applications with respect to availability of input data and impact on the energy performance.
- Preparation of an overall continuous but modular structure, e.g. in the form of a basic standard on the integrated energy performance of buildings, re-using the main elements of EN 15603 (Overall energy use and definition of energy rating) and core elements of other key standards, including common definitions, terms and symbols, enabling a step-by-step implementation by the Member States, taking also into account the nature of each procedure identifying the typical type of user. Preparing and applying a systematic hierarchic numbering of the standards of the set could be an additional asset.
- It is important to send clear messages on the work being done and the timeline, to enable national standard writers and policy makers to participate actively in the process and to plan the implementation in the national or regional procedures/building regulations.
- Per cluster of standards on a specific subject technical recommendations have been prepared by the CENSE teams who focused on a specific subset of the CEN-EPBD standards. These technical recommendations can be found in the separate reports.

The revision of the standards and a corresponding revision of national methods and regulations will within the next five years enable the EU Member States to make a more direct use of the harmonized CEN procedures.

There is also a strong interest in ISO in the subject, which culminated in the recent (June 2009) establishment of a Joint Working Group in ISO to develop ISO (EN ISO) standards on energy
performance of buildings, using the EPBD - CEN standards as a basis. This creates a unique opportunity for Europe to retain the lead on the preparation of energy performance standards in a combined CEN-ISO effort.

A positive signal is also noted from the Commission. There is a growing chance for a second mandate to CEN related to the EPBD. In this context, DG ENER has high expectations for the outcome from the CENSE project.

The need of positive signals towards a European common methodology
Various target groups underline the benefits of a Europe wide unified framework (knowledge share, avoid of duplications of efforts, fair competition, more transparency and better chances for innovation).

The first EPBD – CEN package has in general already a good quality compared to national methods. The quality and usability would be increased by the second generation.

But how to get the Member States to make the switch from their national method, in which also a lot of effort has been invested (e.g. training of the professionals) to the European method, especially on a short notice?

To bring the EPBD – CEN package to application there are several options:
- Wait until the national methods are voluntarily replaced by the European methods;
- Make the application of the EPBD – CEN package mandatory;
- Give the market forces the possibility to do it.

The first option will probably take a lot of time, because the driving forces are national, with a stronger national interest than a European one.

The second option is strongly supported by target groups working on the European level, because the national methods raise new barriers for the free circulation of products and services in Europe. For several reasons, there are hesitations from the side of the Commission to enforce a 100% mandatory application.

The third option, using the market forces, could lead to a soft convergence of national methods and the European one. In this option, a methodology, based on the EPBD - CEN package, should be admitted in parallel to the national method, to fulfil the national building codes requirements. The justification would be that national monopolistic positions for methodologies and software are not compatible with the objective of a European market. At the same time it would stimulate countries to write National Annexes or National Application Documents if and where they fear that the parallel routes would lead to different results.

A neater and better organized second generation of CEN standards is a necessary condition to make this a feasible option in practice; although in some Member States the use of the EPBD – CEN package as an option to fulfil the national building codes requirements (without further national specification) is already authorised.

A contribution to the perspective of EU-wide application of the EPBD-CEN standards, is the expectation that the comparative methodology framework to identify cost-optimal levels of energy performance requirements for buildings and building elements, an important element in
the EPBD recast, should be based on European standards (recast annex III). It will be very constructive to benchmark the national methods by the unified European methodology, to analyse the differences and to update the methods by the best practice. The CENSE partners are looking forward to discuss with DG ENER how to avoid that the development of the common method for cost-optimum calculations and the preparation of the second generation of CEN standards will diverge and miss the opportunity of synergy. In this respect we should learn from the lack of compatibility in the procedures developed under the EuPD with the EPBD - CEN package.

3.5 Rough project on the cumulative energy savings

Access to a calculation methodology in the form of European standards makes it possible to harmonize the various measures for improving the energy efficiency in buildings between the Member States. It increases the accessibility, transparency and objectivity of the energy performance assessment in the Member States, as mentioned in the EPBD. Construction products, appliances and services related to buildings are an important part of the EU internal market. The establishment of a harmonized approach creates the basis for coherent, mutually reinforcing exchange of experiences within the EU, but also with third countries. Third countries can refer to European standards and this will serve to establish the Union as a forerunner in energy efficiency improvements, which would also be beneficial for EU business.

The direct impact of a better calculation methodology to the energy savings in the building sector is difficult to estimate. In case of new or renovated buildings when the method is used to check compliance with minimum energy performance requirements, it is easy to obtain a 10-20% higher energy savings if the applied method is capable to give clear and just guidance on the energy saving capabilities of the measures, compared with a method where such guidance is not optimised, leading to sub-optimal choices.

In addition, harmonisation across Europe will lead to more international information exchange on the potential of innovative technologies. This will lead to an faster market penetration, a faster cost reduction and thus a faster shift in the cost-optimal level of the minimum EP requirements.

3.6 Concise presentation of three workshops/conferences

Paragraph 3.3.2 gives an overview of the organised CENSE workshops and conferences. Three of the main workshops are taken out for a detailed description and conclusions.

CENSE Software Workshop, Brussels, 29 June 2009
The purpose of this workshop is to explore the CENSE standards with software companies considering the regulatory market as an extension to existing design tools or e.g. as part of building stock maintenance tools. This has been reached by informing the software companies about the present legal situation and the use of such software in Europe, exchanging views and opinions (interest on a common European method, linking regulation and design) and discussing and identifying common actions to push forward the development and application of a European energy calculation.
The workshop were visited by 42 participants coming from 17 countries. The majority of the participants are representing software companies. Energy experts, industrials, energy suppliers, standard writers and authorities (European, national, regional level) are also attending the meeting. The participants reported that often they have to struggle with low quality public software, developed with limited budgets. They are in favour of a common procedure 1) (method with a modular structure) in order to reach higher quality workflows and to avoid duplication of effort by international cooperation. The common method could be tailored to individual country requirements in national annexes (i.e. national weather data).

A view was expressed that there should be enough flexibility to allow each country to respond and comply EPBD in their own way to suit their existing custom and practices. This includes the facility for designers to use the same software for design and compliance and avoid duplication of data input. Some participants drew the attention to the risk, that if there will be one software tool there could be less stimulation for the future development.

The question raises who, and on what basis, will choose one method for calculation when CEN standards provide a lot of options. The answer could be the Italian approach – set the boundaries conditions at national level on when to use the detailed or simplified method. For the software it is not problem to include all the options provided by CEN standards. Countries have already their own software(s) and procedures – it will be difficult to overcome this obstacle.

The idea of using the EN standards in the Member State regulations should be the target. Even if it looks like the beginning of a 5 years story, we should all work in this direction. It is the right time to start.

The final conclusions, actions and recommendations of the workshops were briefly:

- Create a "software community" on Internet
- Prepare a company profile template to facilitate the business contacts between the software community
- Declaration of interest to the workshop convenor. Indicate preference for direct participation or creating of a mirror group
- Create of mirror group "EN 12831" within the software community
- Declare interest in practical application to the convenor of the workshop with participants from Croatia, Slovenia, Turkey

The evaluation showed that the subject of the workshop were indicated as good to very good. The workshop have fulfilled the objectives by 90% of the participants and the speakers at the workshop were assessed as good to very good.

The aim of the conference was to share information and combine efforts to bring the standards to application:

- Inform on current developments relating to the EPBD recasting (common methodology)
- How a set of common standards would support:
  - Correct implementation of the EPBD (i.e. Transparency)
  - Industries (comparable technical assessments approaches)

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1) It is important to distinguish between "procedure" and "software". A procedure is the description of how to calculate, whereas the software is a tool, the electroncial application of the procedure.
• Member States (ie Efficiency)
  • Providing successful examples of the use of the EPBD standards
    • By Member States
    • By software

What remains to be done to realise the full potential?
• What changes are to be recommended for revision of the set of CEN-EPBD standards
  (“second generation” of CEN (CEN ISO) standards on energy performance of buildings)
• How to combine efforts to bring the standards to application?

About 40 participants (sold out) were present at the conference, of which 14 experts are active in CENSE. All other participants were representing stakeholders.

The discussions are reported under the different sections and at the end a more general discussion. The main issues in this discussion were:
• What remains to be done to realise the full potential of the standards?
• How to combine efforts to bring the standards to application?

The conference proved that there is a wide interest by many target groups in Europe. Participants from 12 countries, representing the European Commission, the European Environmental Citizens' Organisation for Standardisation, the European Industry (Thermal insulation, heating, ventilation, lighting), Building professionals (REHVA, software developers), Universities and research institutes, attended the conference.

The main conclusions of the conference are the followings:
• There is a strong interest in a second generation of EPBD - CEN standards to assess the energy performance of buildings. Based on the experience of the first generation, a second generation is needed to facilitate the implementation in the EU Member States, to disseminate the European experience as a support to the European Industry and to enhance harmonization at global level (bring CEN standards to ISO).
• There is a need of positive signals towards a European common methodology.

There is also a strong interest in ISO in the subject, which culminated in the recent establishment of a Joint Working Group in ISO to develop ISO (EN ISO) standards on energy performance of buildings, using the EPBD - CEN standards as a basis. This creates a unique opportunity for Europe to keep the lead on energy performance standards in a combined CEN-ISO effort.

A positive signal at the conference came from the Commission representative. There is a growing chance for a second mandate to CEN related to the EPBD. In this context, DG TREN has high expectations for the outcome from the CENSE project.

Several presentations underlined the benefits of a Europe wide unified framework (knowledge share, avoid of duplications of efforts, fair competition, more transparency and better chances for innovation).

But how to get the Member States to make the switch from their national method, in which also a lot of effort has been invested (e.g. training of the professionals) to the European method, especially on a short notice?
To bring the EPBD – CEN package to application there are several options:

- Wait until the national methods are voluntarily replaced by the European methods;
- Make the application of the EPBD – CEN package mandatory;
- Give the market forces the possibility to do it.

The first option will probably take a lot of time, because the driving forces are national, with a stronger national interest than a European one.

The second option is strongly supported by target groups working on the European level, because the national methods raise new barriers for the free circulation of products and services in Europe. The majority of the conference participants were also in favour of this option. But for several reasons, very clearly explained in the presentation of the Commission representative, there are hesitations to enforce a 100% mandatory application.

The third option, using the market forces, could lead to a soft convergence of national and the European method. In this option, a methodology, based on the EPBD - CEN package, should be admitted in parallel to the national method, to fulfil the national building codes requirements. The justification would be that national monopolistic positions for methodologies and software are not compatible with the objective of a European market. At the same time it would stimulate countries to write National Annexes or National Application Documents if and where they fear that the parallel routes would lead to different results.

CENSE-conference, EU-Sustainable week, Brussels, 22-03-2010

The workshop was organised to present the main results of the project, in particular the packages with information on the set of CEN standards to support the EPBD and a series of recommendations regarding a second generation of these standards. This should also be seen in relation to the recently decided revision (recast) of the EPBD. The existing standards are being used very differently in the EU Member States. Some have implemented them fully, most have used some of the standards or excerpts of the standards and some others are not using the standards at all. On the other hand, there are many groups and organisations that would like to see more harmonized calculation procedures in Europe for evaluating the energy performance of buildings and HVAC systems. This is also the intention of the European Commission, as indicated by the recast of the EPBD. The workshop is organised in collaboration with CEN and REHVA and hosted by and held at the Office of CEN in Brussels.

Target groups of the workshop: Policy makers, consultants, building products and HVAC manufacturers, those responsible for writing building codes, educators.

The main final conclusions that could be derived from the workshop are:

- CEN-EPBD standards are used in many EU Member States, but often in a “practical way”: by copying and/or completing parts of CEN standards into national standards or building codes. A more direct implementation is strongly preferred, but requires adaptation of the CEN-EPBD standards following common rules and a common format.

- The Recast of the EPBD was highlighted against the existing situation of the Directive on the energy performance of buildings and it was concluded as very useful that within the EPBD Recast a mandate for a second generation of CEN standards is potentially foreseen.
• The Recast requires a wider application range of the methodology, more attention to (links with) inspection and to component requirements and closer links to related Directives.

• The methodology laid down in the CEN standards should also be used in the context of the calculation of the cost effectiveness of the minimum requirements.

• The design of the second generation of the CEN standards is urgently needed. It will give a more consistent, clear, unambiguous and a better structure to the new set of CEN standards. It will lead to easier international knowledge exchange and shared research, increased circulation of products, services and property data. Also it will give Europe more influence on the process to come to global standards on energy performance of buildings in cooperation with the ISO.

The workshop was well received by the participants. In total, 45 persons attended the workshop, whereof 7 persons from the organisation team. The participants assessed the importance of the subject of the workshop with high priority, actual as well as in the future. The overall quality of the workshop was also assessed as good to very good.

3.7 Specific examples

Here some specific examples of very interesting activities organised by the CENSE project

3.7.1 Immediate impact of recommendations given

Within the work of Work package 3 of the CENSE-project, the CEN-standard on lighting “EN 15193: Energy Performance of Buildings - Energy Requirements for Lighting” was inspected, by an European inquiry about its structure and content, amongst others by a questionnaire and workshops. In conclusion, the standard can generally be regarded a big step forward, concerning the implementation of energy efficient lighting concepts. It offers a useful umbrella framework of different methods and ways to determine lighting energy needs. Nevertheless, the feedback also suggested that further improvements should be considered within the next review phase of the standard. Editorial and structural clarifications should be tackled as well as some technical aspects, which have not yet been addressed sufficiently.

These results were presented and discussed in a workshop organized for the members of CEN/TC 169 “Light and Lighting”, responsible for standards in the field of vision, photometry and colorimetry. Already in the following Plenary Meeting of CEN/TC 169 on the next day, these issues were mentioned and, furthermore, it was decided to work out specific proposals implementing two of the recommendations given by CENSE, regarding the rating of the installed power as well as the estimation of daylight contribution by responsive facades.

3.7.2 Tighten the links between software and standards

During the discussions with building authorities, building professionals and industrials the importance of tools to apply regulation and standards were underlined. Therefore in June 2009, the CENSE project organized a meeting in Brussels dedicated to software. Participants from 17 countries attended the meeting. After this event a community on software has been set up on the BUILD UP portal (21 members). The link between software and
standards has been tightened. Several software companies joined the standardisation working groups.

3.7.3 Practical use of the CENSE standards

During the project a red thread was detected in the feed back from the Member States: most MS did make significant use of the CEN standards, and they were very positive in an increased use, but the main handicap appeared to be the loose formulation of the procedures in the standards. This made the standards unfit as direct reference. For instance: in many standards contain phrases like "It may be considered…", "….to be defined at national level…", "…shall include at least…", "…may also include…", or the equations are not fully spelled out, including references for all input variables, leading to ambiguities that are not acceptable for national application in the context of building regulations. The resulting "practical use" of the standards by the MS makes it practically impossible to make an overview of the choices made at national level. In CENSE we worked out a proposal for a common structure of the standards that will hit two birds with one stone: more unambiguity on one hand and more clarity on national choices (including possibility for comparison between countries) on the other.
4. Dissemination

The dissemination and communication during the action was based on several actions. The most extensive work has been related to the production of Information papers, power points and frequently asked questions for all standards. All the results hereof have been posted on the public site of the website. Development of workshops/seminars/conferences has had a two-way effect: Inform the participants on the CEN-standards and obtaining feedback from the participants by questionnaires and general discussions. Final reports are posted on the web-site. Separate questionnaires for special issues and standards have been distributed to stake holders. The results are posted as reports on the web-site. Finally several members of the CENSE project has made presentations and papers at conferences, seminars and other meetings. These presentations and papers are also posted on the web-site if copyrights allow this.

The diagram illustrates the different methods of dissemination and communication.
4.1 The CENSE outcome

A lot of dissemination actions were undertaken during the action. The common dissemination actions, especially in the second part of the action turned out to be very successful. The main activities and outcome are the following:

- A web site alone will not increase the communication and dissemination. Our experience shows that several activities must be done to trigger interest in visiting the web site. Also there must be useful information and “products” that the visitors on the web-site find interesting. Therefore our web site was mainly visited in the second half of the project, where information papers, presentations and several activities regarding conferences and seminars were made.
- Many questionnaires were used to get information from different groups of stakeholders. In general it was very difficult to get a high response frequency.
- The conferences/seminars/workshop activities were in most cases successful; but a couple had only very few participants.
- The detailed contact with a few countries in implementing the CEN standards in the national building codes was very successful; but only because they had not yet made their own national standards or building codes like most of the European countries.
- The CENSE activities did also have an influence outside Europe, especially on the ISO standardization process. Our activities at ASHRAE meetings and other international conferences did have an impact on the approach to building energy certification in these countries. ASHRAE is now introducing a voluntary US-Building certification, which in many ways looks like the European approach.
- To help the educators PowerPoint Presentations are provided with notes explaining the content. This should make them more usable and clear. For this purpose the responsible authors for the different PowerPoint Presentations have add a text in the notes section of the presentations. Besides a course plan is developed and distributed to technical universities in the Member States.

4.2 Workshops/Events

Many of the workshops/seminars have been organised within a conference (see also 3.3.2). The number of participants varied up till 100. Others have been organised together with meetings of associations and some as stand alone CENSE activities focusing on special CENSE items e.g. EPBD Software and CEN recommendations. From most of them we have attendance lists and feedback via evaluation questionnaires (see respective reports on CENSE WEB-site). The workshop/seminars/conference activities had a dual way purpose. It is a part of our dissemination activities and at the same time a way of getting feedback related to the EPBD-CEN standards.

4.3 Role and Impact of interactions at national level

A lot of questionnaires were sent to the stakeholders in the various member states. These questionnaires had a dual function. First of all the intention was to get feedback from different stakeholder groups on their opinion on the implementation on national level of the EPBD-related standards and secondly also to disseminate information on the standards and their use. Besides
questionnaires handed out at workshops/seminars/conference, most of the questionnaires have been e-mailed directly to different stakeholders. If the number of responses was low a second reminder was sent to the respondents. The results can be found on the web-site (detailed results at internal part, condensed version at public part).

4.4 Websites and Newsletters

The website of the project includes all the information developed during the project, divided in a public and internal part. Interested people can find everything there. The question is, however, how we get people to use actively the web-site. The statistic on the number of visitors were very low in 2008; but has now increased significantly in 2009. As more and more people will be aware of the CENSE project and CEN-standards this web-site will be available till minimum 2 years after the end of the project.

Initially a factsheet of the CENSE project was produced and posted on the website. This fact sheet was updated at the the end of the project with the final results. No newsletters were produced but instead several presentations were given about the CENSE project at events visited by many target groups of the CEN-EPBD standards. This turned out to be very efficient and successful.

4.5 Information on the use of the website

On the website it is possible to follow the number of visits and see what they look for. Information papers and events are in general the ones attracting most visitors. In 2009 the number of visitors increased significantly. In 2008 it was mainly the CENSE partners that used the web-site. An event like the CEN-CENSE conference in Paris on September 25 attracted many visitors to the page; around 1/3 of the visitors signed up there for the conference (see Diagram 1).

4.6 CENSE in the media

Examples of papers produced and dissimilated via the various media during the action:


2. Olesen, B. W. Stehen EN 1264 und EN 15377 im Widerspruch? Neue europäische Normen zum Planen und Bemessen von wasserführenden Flächenheizungen und -kühlungen
   Presented at: Internationale Uponor Kongress. Cristoph/Tirol, Germany, 30 March -5 April, 2008. : 30. Internationale Uponor Kongress,

3. Olesen, B.W. “Calculation of the yearly energy performance of heating systems according to CEN standards” HVAC+R Technology Symposium and Exhibition, Istanbul, Turkey 12-14 May 2008, 8th International HVAC+R Technology Symposium and Exhibition, Istanbul, Turkey


6. Hogeling, J., "How do the EPBD standards support the implementation of the directive?", presentation at 5th CEN-CENELEC Annual Meeting, Session: Energy Efficiency Buildings, Madrid, July 1, 2009


11. Dijk, D van, "Intercomparison of EP requirements without harmonized Standards? Why we need a 2nd generation CEN standards ", ASIEPI web event 10, February 12, 2010

As example a summary of a general article about the CEN-EPBD standards in the ISO magazine ‘FOCUS’ is quoted in the following window.

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**Quoted from the CEN-EPBD standard publication in the ISO magazine ‘FOCUS’**

The lack of internationally agreed terms, definitions and procedures makes it very difficult to compare minimum energy performance requirements between countries, or to understand and compare data gathered on measured energy use of buildings. For this reason, a coherent set of International Standards is urgently needed for assessment and calculation, rating and labelling, and standards for best practice and improvement of energy performance in buildings. Such standards would enable meaningful comparisons of actual energy use, and of the potential for novel energy saving and renewable energy technologies at a global level. They would also facilitate the market for services related to energy use in buildings. Various ISO technical committees have been active in the field of energy in buildings, each from different perspectives. This is particularly true for ISO technical committee ISO/TC 163, Thermal performance and energy use In the built environment and ISO/TC 205, Building environment design. For this reason, these two committees have joined forces to establish a joint working group aimed at fostering a smooth and rapid development of energy efficiency standards for the global building industry.

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5. Conclusions and recommendations

5.1 Conclusions

The following main conclusions can be derived from the project:

- **Consistency, Structure and Format**
  To enable and encourage the further use of the European CEN-standards, a clear and uniform structure is essential, for each standard as well as for the complete set of standards. This includes, amongst others, a distinction between common procedures and options to be chosen at national level as well as fully spelled out equations, using the available common set of terms, with unambiguous links between input and output. In addition consistent numbering of the standards, indicating their relation would be helpful.

- **Applicability**
  Several aspects are essential to ensure and improve the standards applicability. First, the standards are meant to serve as a framework, to enable national flexibility encouraging the countries to apply them. Second, the options possible need to be clarified and their number reduced. Third, the standards must cover all tasks and building types, such as existing buildings, retrofitting or planning of new buildings, including the early planning period. This includes identifying and taking care of existing gaps. In addition, the standards’ methodologies should be “software-proof”, keeping in mind that software-developers will implement the methods creating usable software-tools. In consequence of increasing software use there is generally no need for simplified procedures but for simplified input data.

- **Keeping the standards up to date**
  To keep up with rapid innovative development in the building related energy field (regarding all issues, e.g. technical systems, control techniques or building components), it is essential to promptly include respective calculation procedures. Close cooperation with industry and research centres as well as regular reviews, will help to fulfill this challenging task. Until appropriate computer programs are developed a general feeling is that the EPBD standards are too complicated to use.
  In the future, the CEN standards should be read mainly by software developers because the standards will only be applied efficiently by high quality tools.

5.2 Recommendations

The following (summary of) the recommendations can be derived from the project:

- A more uniform structure for each of the standards in the package.
With a distinction between common procedures and options to be chosen at national level; this will bring more clarity in the adoption of the procedures and the specific choices per country;

- Fully spelled out equations and unambiguous links between input and output, making the standards ready-to-use for validation and software preparation;

- Use of the available common set of terms, definitions and symbols & subscripts, the latter also for all versions and national application documents in other languages.

- Rationalisation of the number of options given in the standards, each option aiming at specific applications with respect to availability of input data and impact on the energy performance.

- Preparation of an overall continuous but modular structure, e.g. in the form of a basic standard on the integrated energy performance of buildings, re-using the main elements of EN 15603 (Overall energy use and definition of energy rating) and core elements of other key standards, including common definitions, terms and symbols, enabling a step-by-step implementation by the Member States, taking also into account the nature of each procedure identifying the typical type of user. Preparing and applying a systematic hierarchic numbering of the standards of the set could be an additional asset.

- It is important to send clear messages on the work being done and the timeline, to enable national standard writers and policy makers to participate actively in the process and to plan the implementation in the national or regional procedures/building regulations.

- Per cluster of standards on a specific subject technical recommendations have been prepared by the CENSE teams who focused on a specific subset of the CEN-EPBD standards. These technical recommendations can be found in the separate reports.

The revision of the standards and a corresponding revision of national methods and regulations will within the next five years enable the EU Member States to make a more direct use of the harmonized CEN procedures.

There is also a strong interest in ISO in the subject, which culminated in the recent (June 2009) establishment of a Joint Working Group in ISO to develop ISO (EN ISO) standards on energy performance of buildings, using the EPBD - CEN standards as a basis. This creates a unique opportunity for Europe to retain the lead on the preparation of energy performance standards in a combined CEN-ISO effort.

A positive signal is also noted from the Commission. There is a growing chance for a second mandate to CEN related to the EPBD. In this context, DG ENER has high expectations for the outcome from the CENSE project.

### 5.3 Expected impact of the CEN-EPBD standards

The expected impact of a second generation of CEN-EPBD standards are briefly:

- CEN standards are more usable as direct reference; high transparency in national choices
- Easier international knowledge exchange and shared research
- Increased circulation of products, services and property data
- Faster implementation of new solutions
• Increased credibility of EU in the world
• High performance European tools leading to high performance buildings
6. References


   This document is available in 9 languages (English, German, French, Danish, Finnish, Dutch, Polish, Italian and Spanish)

   This document is available in 9 languages (English, German, French, Danish, Finnish, Dutch, Polish, Italian and Spanish).

4) CENSE BOOKLET 1, Compilation of Information Papers introducing the CEN standards concerning Overall Energy Performance of Buildings, April 2010

5) CENSE BOOKLET 3, Compilation of Information Papers introducing the CEN standards concerning Building Energy Performance, April 2010

6) CENSE BOOKLET 3, Compilation of Information Papers introducing the CEN standards concerning Heating Systems and Domestic Hot Water, April 2010

7) CENSE BOOKLET 4, Compilation of Information Papers introducing the CEN standards concerning Ventilation and Cooling Systems, April 2010

8) CENSE BOOKLET 5, Compilation of Information Papers introducing the CEN standards concerning Inspection of Systems for Heating, Air conditioning and Ventilation, April 2010

9) CENSE WP2.3 N02, Overview on the practical use of the CEN standards (EPBD), Kees Arkesteijn and Dick van Dijk, September 2008

10) CENSE WP2.3 N03, Report on the application of two key standards for the EPBD: EN 15603 (Overall energy use and definition of ratings) and EN 15217 (Methods for expressing energy performance and for energy certification of buildings), Kees Arkesteijn and Dick van Dijk, May 2010


13) CENSE WP3.3 N04, Report on the application of the series of EN ISO standards on thermal transmission properties of building components and building envelope. EN ISO
6946, 10077, 10211, 10456, 13370, 13786, 13789, 14683; EN 13947, Dick van Dijk, Anna Staudt and Hans Erhorn, May 2010

14) CENSE WP4.3 N01, Enquiry Analysis of the CEN-standards on Heating Systems and Domestic Hot water. Recommendations, Johann Zirngibl and Claude François, March 2010

15) CENSE WP5.3 N01, Enquiry Analysis of the CEN-standards on Ventilation and Air Conditioning. Recommendations, Hicham Lahmidi, May 2010

All these documents and more additional information, like the Information Papers and PowerPoint presentations, database with frequently asked questions and reports of the various CENSE workshops are separately available on the CENSE website: http://www.iee-cense.eu/