Energy Performance of Buildings

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PROJECT DOCUMENT

Status: PUBLIC

ANNEXES

to report

Background, status and future of the CEN standards to support the Energy Performance of Buildings Directive (EPBD)

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CENSE_WP6.1_NO3A **April 29, 2009**

IEE-CENSE

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

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Contents

Annex A – List of CEN standards to support the EPBD

Introduction

The standards are arranged by hierarchy, in accordance with annex A of CEN/TR 15615 (the "Umbrella Document"). This introduction describes the role of the standards in each section and is based on CEN/TR 15615 (the "Umbrella Document").

Section 1 – Standards concerned with calculation of overall energy use in buildings

Standards in this section provide a link between delivered energy and the energy performance indicators for buildings. Since a building generally uses more than one fuel (e.g. gas and electricity), the different energy sources are collected per energy carrier. The overall rating is based on a weighted sum of delivered energy carriers. The weightings can be related to, for instance, primary energy or CO_2 emissions, to provide the end result of the calculation of energy performance (Article 3 of the Directive).

EN 15603 defines the uses of energy to be taken into account and provides methods to assess energy performance energy ratings for new and existing buildings.

EN 15217 sets out ways of expressing the energy performance in a certificate (Article 7), and ways of expressing requirements as to the energy performance (Articles 4 to 6).

EN 15459 provides a calculation method for the economic issues of heating systems and other systems that are involved in the energy demand and energy consumption of the building.

Section 2 – Standards concerned with the calculation of delivered energy

Standards in this section provide the link between the building's energy needs and delivered energy for space heating and cooling, and also the energy requirements for ventilation, domestic hot water and lighting. The uses of energy are calculated separately:

a) Space heating – EN 15316-1, EN 15316-2-1, EN 15316-2-3, the parts of EN 15316-4 (depending on the type of heating system), including losses and control aspects, and EN 15377 for embedded systems. The input to the calculation is the result from EN ISO 13790 (using either a simplified method or a dynamic simulation, see section 3).

b) Space cooling – EN 15243, including losses and control aspects, and energy for dehumidification if applicable. The input to the calculation is the result from EN ISO 13790 (using either a simplified method or a dynamic simulation, see section 3).

c) Domestic hot water – the parts of EN 15316-3, which include both the specification of domestic hot water requirements for different types of building, and the calculation of the energy needed to provide it.

d) Ventilation – EN 15241, energy needed to supply and extract air, based on installed fan power and controls, including energy for humidification if applicable.

e) Lighting – EN 15193, based on installed lighting power and annualised usage according to building type, occupancy and lighting controls.

f) Integrated building automation and controls – EN 15232, takes into account additional energy optimisation based on interdisciplinary control functions and applications for space heating, ventilation, cooling, domestic hot water and lighting.

All of these standards take into account renewable energy sources where appropriate.

Section 3 – Standards concerned with calculation of energy needs for heating and cooling

Standards in this section provide methods for the calculation of energy needs for heating and cooling.

EN ISO 13790 defines two routes for this:

a) Simplified methods based on monthly or hourly calculations and simplified description of the building (in terms of element *U*-values, etc). The inputs to these calculations are obtained using the standards in Section 4.

b) Detailed numerical calculations. The detailed calculation procedure is not specified in the standard. EN 15265 provides criteria that should be followed together with tests for the validation of computer software (although the tests cover only simple cases and do not include systems).

The choice of calculation method to be applied is to be made at national level. The choice may be determined by criteria such as reproducibility (for comparability and in case of legal requirements), accuracy (in appreciating the building and system provisions and/or specific conditions) and cost effectiveness (of gathering the input). These criteria may be conflicting. For that reason the choice will typically depend on the use of the building (residential, office, etc.), the complexity of the building and/or systems, and the application (e.g. regulatory requirements, energy certification, new buildings, existing buildings).

The rules given in EN ISO 13790 for the use of different calculation methods ensure compatibility and consistency between them. The standard provides, for instance, common rules for the boundary conditions and physical input data irrespective of the chosen calculation approach.

The calculations take account of control aspects that affect the heat gains and losses of the building, such as control of internal temperature, ventilation and solar protection.

Section 4 – Supporting standards

These standards provide the input data for the calculation of energy needs by the methods in Section 3.

Section 4A Thermal performance of building components

Section 4A includes standards for the calculation of the thermal performance of building components. The overall transmission heat loss coefficient is obtained by EN ISO 13789, which refers to other standards for the calculation of *U*-values. The standards for *U*-values fall into two groups:

a) simplified methods (EN ISO 6946, EN ISO 13370, EN ISO 10077-1, EN 13947), which can be used for components within the scope of those standards; and

b) detailed methods (EN ISO 10211, EN ISO 10077-2), which can be used as an alternative, or for cases for which there is not an applicable simplified method.

The *U*-value of components, including windows and doors, can alternatively be established by measurement according to test methods cited in an applicable product standard.

Thermal bridges (at junctions between elements, etc) are covered in EN ISO 10211 and EN ISO 14683.

The standards in this group also include those for obtaining thermal values of building materials (EN ISO 10456).

Section 4B Ventilation and air infiltration

Section 4B includes standards for assessing ventilation and air flow rates. EN 15242 provides methods for calculation of air flow rates to enable the calculation of heat losses due to air exchange. EN 13779 covers mechanically ventilated buildings (including those with air conditioning).

Section 4C Overheating and solar protection

Section 4C includes standards for estimating internal temperatures without air-conditioning, and for calculating the effect of solar protection devices. These calculations can be used to determine whether there is a need to consider air conditioning.

Section 4D Indoor conditions and external climate

Section 4D includes standards related to indoor conditions (EN 15251) and specifications for the calculation and presentation of climatic data (EN ISO 15927).

Note The parts of EN ISO 15927 do not actually contain climatic data, but rather a specification for such data, so that data in conformance with this standard are determined and established on a consistent basis and a uniform format.

Section 4E Definitions and terminology

Section 4E includes EN ISO 7345, EN ISO 9288, EN ISO 9251 and EN 12792, which contain definitions of terms and quantities used by other standards.

Section 5 – Standards concerned with monitoring and verification of energy performance

These standards include the determination of air leakage rates and infra-red thermography, which can be used in the verification of the energy performance of buildings.

Also included are standards on inspection of heating systems and air conditioning systems, which relate to Articles 8 and 9 of the Directive.

List of EPBD related CEN and CEN-ISO standards

The standards with the number in blue font are part of the Mandate M343 from the European Commission to CEN.

GENERAL
TR 15615 Explanation of the general relationship between various European standards and the Energy Performance of Buildings Directive (EPBD) - Umbrella document. **CONTENT:** This technical report describes the European standards (ENs) that are intended to support the EPBD by providing the calculation methods and associated material to obtain the overall energy performance of a building. In Annex A the standards concerned are arranged in a hierarchical fashion. The content of the individual standards is summarised in Annex B. Annex C provides a list of definitions, and Annex D a list of principal symbols, that are used consistently in the standards.
Section 1 - Standards concerned with calculation of overall energy use in buildings (based on results from standards in section 2)
EN 15217 (June 2007) Energy performance of buildings — Methods for expressing energy performance and for energy certification of buildings **CONTENT:** Defines: a) 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 b) Ways to express energy requirements for the design of new buildings or renovation of existing buildings c) Procedures to define reference values and benchmark d) Ways to design energy certification schemes
EN 15603 (Jan. 2008) Energy performance of buildings — Overall energy use and definition of energy ratings **CONTENT:** This standard specifies a general framework for the assessment of overall energy use of a building, and the calculation of energy ratings in terms of primary energy, CO2 emissions or parameters defined by national energy policy. Separate standards calculate the energy use of services within a building (heating, cooling, hot water, ventilation, lighting) and produce results that are used here in combination to show overall energy use. This assessment is not limited to the building alone, but takes into account the wider environmental impact of the energy supply chain.
EN 15459 (Nov. 2007) Economic evaluation procedures for energy systems in buildings **CONTENT:** Provides data and calculation methods for economic issues of heating systems and

other systems that are involved in the energy demand and consumption of the building
Section 2 – S**tandards concerned with calculation of delivered energy (based where relevant on results from standards in section 3)**
EN 15316-1 (July 2007) Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 1: General **CONTENT:** Standardises the required inputs, the outputs and the structure of the calculation method for system energy requirements. Energy performance may be assessed either by values of the system efficiencies or by values of the system losses due to inefficiencies. Based on an analysis of the following parts of a space heating and domestic hot water system: - the emission system energy performance including control; - the distribution system energy performance including control; - the storage system energy performance including control; - the generation system energy performance including control (e.g. boilers, solar panels, heat pumps, cogeneration units).
EN 15316-2.1 (July 2007) Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 2-1: Space heating emission systems **CONTENT:** Energy performance may be assessed either by values of the heat emission system performance factor or by values of the heat emission system losses due to inefficiencies. Method is based on an analysis of the following characteristics of a space heat emission system including control: - non-uniform space temperature distribution; - emitters embedded in the building structure; - control of the indoor temperature
EN 15316-4 (July 2007 – Nov. 2008) Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies – **CONTENT:** Provides methods for system efficiencies and/or losses and auxiliary energy. Consists of seven parts: EN 15316-4.1 Space heating generation — Combustion systems (boilers) EN 15316-4.2 Space heating generation — Heat pump systems EN 15316-4.3 Heat generation systems, thermal solar systems. EN 15316-4.4 Heat generation systems, building-integrated cogeneration systems. EN 15316-4.5 Space heating generation systems, the performance and quality of district heating and large volume systems. EN 15316-4.6 Heat generation systems, photovoltaic systems EN 15316-4.7 Space heating generation — Biomass combustion systems

EN 15316-2.3 (July 2007)

Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 2-3: Space heating distribution systems.

CONTENT: Provides a methodology to calculate/estimate the heat emission of water based distribution systems for heating and the auxiliary demand as well as the recoverable heat emission and auxiliary demand.

EN 15316-3 (Oct. 2007)

Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies — Domestic hot water systems

CONTENT: Calculation of energy requirements for domestic hot water heating systems including control, for all building types. In three parts:

EN 15316-3.1 Domestic hot water systems, characterisation of needs (tapping-patterns).

EN 15316-3.2 Domestic hot water systems, distribution.

EN 15316-3.3 Domestic hot water systems, generation.

EN 15243 (Aug. 2007)

Calculation of room temperatures and of load and energy for buildings with room conditioning systems

CONTENT: Defines procedures to calculate temperatures, sensible loads and energy demands for rooms; latent room cooling and heating load, the building heating, cooling, humidification and dehumidification loads and the system heating, cooling, humidification and dehumidification loads.

Gives general hourly calculation method, and simplified methods.

EN 15377 (2005 – Oct. 2007)

Design of embedded water based surface heating and cooling systems in 3 parts:

CONTENT: Applies to water based surface heating and cooling systems in residential, commercial and industrial buildings, for systems integrated into the wall, floor or ceiling construction without any open air gaps. In three parts:

EN 15377-1 Determination of the design heating and cooling capacity (2005)

EN 15377-2 Design, dimensioning and installation

EN 15377-3 Optimising for use of renewable energy sources (Oct. 2007)

EN 15241 (May 2007)

Ventilation for buildings — Calculation methods for energy losses due to ventilation and infiltration in commercial buildings

CONTENT: Describes method to calculate the energy impact of ventilation systems (including

airing) in buildings to be used for applications such as energy calculations, heat and cooling load calculation. Its purpose is to define how to calculate the characteristics (temperature, humidity) of the air entering the building, and the corresponding energy required for its treatment as the auxiliary electrical energy required.
EN 15232 (July 2007) Energy performance of buildings Impact of building automation, controls and building management. **CONTENT:** Defines and specifies the performance of standardised energy saving and optimisation functions and routines of Building Automation and Control Systems (BACS) and Technical Building Management (TBM) systems and services. Summarises the methodologies to calculate/estimate the energy demand for heating, ventilation, cooling, hot water and lighting of buildings and expresses the results of energy saving and efficiency in buildings by the application of the different BACS energy saving functions.
EN 15193 (Sept. 2007) Energy performance of buildings — Energy requirements for lighting **CONTENT:** Specifies the calculation methodology for the evaluation of the amount of energy used for lighting in the building and provides the numeric indicator for lighting energy requirements used for certification purposes. Also provides a methodology for the calculation of dynamic lighting energy use for the estimation of the total energy performance of the building
Section 3 - Standards concerned with calculation of energy need for heating and cooling
EN-ISO13790 (March 2008) Energy performance of buildings — Calculation of energy use for space heating and cooling **CONTENT:** Gives calculation methods for assessment of the annual energy use for space heating and cooling of a residential or a non-residential building, or a part of it. Includes the calculation of heat transfer by transmission and ventilation of the building when heated or cooled to constant internal temperature; the contribution of internal and solar heat sources to the building heat balance; the annual energy needs for heating and cooling; the annual energy required by the heating and cooling systems of the building for space heating and cooling; the additional annual energy required by a ventilation system. Building can have several zones with different set-point temperatures, and can have intermittent heating and cooling. Calculation period is one month or one hour or (for residential buildings) the heating or cooling season. Provides common rules for the boundary conditions and physical input data irrespective of the chosen calculation approach.
EN 15255 (Aug. 2007) Thermal performance of buildings — Sensible room cooling load calculation — General criteria and validation procedures **CONTENT:** Sets out the level of input and output data, and prescribes the boundary conditions required for a calculation method of the sensible cooling load of a single room under constant or/and floating temperature taking into account the limit of the peak cooling load of the system. It includes a classification scheme of the calculation method and the criteria to be met by a calculation method in order to comply with this standard. Purpose is to validate calculation methods used to evaluate the maximum cooling load for equipment selection and HVAC system design; evaluate the temperature profile when the cooling capacity of the system is reduced;

provide data for evaluation of the optimum possibilities for load reduction; allow analysis of partial loads as required for system design, operation and control.
EN 15265 (Aug. 2007) Thermal performance of buildings — Calculation of energy needs for space heating and cooling systems using dynamic methods — General criteria and validation procedures **CONTENT:** Specifies the assumptions, boundary conditions and validation tests for a calculation procedure for the annual energy use for space heating and cooling of a building (or of a part of it) where the calculations are done on an hourly basis. Does not impose any specific numerical technique. Purpose of this standard is to validate calculation methods used to describe the energy performance of each room of a building; provide energy data to be used as interface with system performance analysis (HVAC, lighting, domestic hot water, etc).
Section 4A - Standards to support the above - Thermal performance of building components
EN-ISO 13789 (Dec. 2007) Thermal performance of buildings — Transmission and ventilation heat transfer coefficients — Calculation method **CONTENT:** Specifies method and provides conventions for the calculation of the steady-state transmission and ventilation heat transfer coefficients of whole buildings and parts of buildings. Applicable both to heat loss (internal temperature higher than external temperature) and to heat gain (internal temperature lower than external temperature).
EN ISO 13786 (Dec. 2007) Thermal performance of building components — Dynamic thermal characteristics — Calculation methods **CONTENT:** Specifies the characteristics related to dynamic thermal behaviour of building components and gives methods for their calculation
EN-ISO 6946 (Dec. 2007) Building components and building elements — Thermal resistance and thermal transmittance — Calculation method **CONTENT:** Method of calculation of the thermal resistance and thermal transmittance of building components and building elements, excluding doors, windows and other glazed units, components which involve heat transfer to the ground, and components through which air is designed to permeate.
EN-ISO 13370 (Dec. 2007) Thermal performance of buildings — Heat transfer via the ground — Calculation methods **CONTENT:** Gives methods of calculation of heat transfer coefficients and heat flow rates, for building elements in thermal contact with the ground, including slab-on-ground floors, suspended floors and basements. It applies to building elements, or parts of them, below a horizontal plane in the bounding walls of the building. Includes calculation of the steady-state part of the heat transfer (the annual average rate of heat flow), and the part due to annual periodic variations in

temperature (the seasonal variations of the heat flow rate about the annual average).
EN 13947 Thermal performance of curtain walling — Calculation of thermal transmittance **CONTENT:** Methods for calculating the thermal transmittance of curtain walls consisting of glazed and/or opaque panels fitted in, or connected to, frames. Detailed and simplified methods. Includes different types of glazing, frames of any material, different types of opaque panels clad with metal, glass, ceramics or any other material, thermal bridge effects at the rebate or joint between the glazed area, the frame area and the panel area.
EN-ISO10077-1 (Sept. 2006) Thermal transmittance of windows, doors and shutters – Calculation of thermal transmittance - General **CONTENT:** Specifies methods for the calculation of the thermal transmittance of windows and pedestrian doors consisting of glazed and/or or opaque panels fitted in a frame, with and without shutters. Allows for different types of glazing, opaque panels, various types of frames, and where appropriate the additional thermal resistance for closed shutters.
EN-ISO10077-2 Thermal transmittance of windows, doors and shutters – Calculation of thermal transmittance – Numerical method for frames **CONTENT:** Specifies a method and gives the material data required for the calculation of the thermal transmittance of vertical frame profiles, and the linear thermal transmittance. Can also be used to evaluate the thermal resistance of shutter profiles and the thermal characteristics of roller shutter boxes.
EN-ISO 10211 (Dec. 2007) Thermal bridges in building construction — Heat flows and surface temperatures — Detailed calculations **CONTENT:** Sets out the specifications for a 3-D and 2-D geometrical model of a thermal bridge for the numerical calculation of heat flows and surface temperatures. Specifications include the geometrical boundaries and subdivisions of the model, the thermal boundary conditions and the thermal values and relationships to be used.
EN-ISO 14683 (Dec. 2007) Thermal bridges in building construction — Linear thermal transmittance — Simplified methods and default values **CONTENT:** Deals with simplified methods for determining heat flows through linear thermal bridges which occur at junctions of building elements. Specifies requirements relating to thermal bridge catalogues and manual calculation methods. Provides default values of linear thermal transmittance.
EN-ISO 10456 (Dec. 2007) Building materials and products — Hygrothermal properties — Tabulated design values and

procedures for determining declared and design thermal values **CONTENT:** This standard specifies methods for the determination of declared and design thermal values for thermally homogeneous building materials and products, together with procedures to convert values obtained under one set of conditions to those valid for another set of conditions. These procedures are valid for design ambient temperatures between -30 °C and +60 °C. It gives conversion coefficients for temperature and for moisture. These coefficients are valid for mean temperatures between 0 °C and 30 °C. It also gives design data in tabular form for use in heat and moisture transfer calculations, for thermally homogeneous materials and products commonly used in building construction.
Section 4B - Standards to support the above - Ventilation and air infiltration
EN 15242 (May 2007) Ventilation for buildings — Calculation methods for the determination of air flow rates in buildings including infiltration **CONTENT:** Describes method to calculate the ventilation air flow rates for buildings to be used for applications such as energy calculations, heat and cooling load calculation, summer comfort and indoor air quality evaluation. Applies to mechanically ventilated buildings; passive ducts; hybrid systems switching between mechanical and natural modes; window opening by manual operation for airing or summer comfort issues.
EN 13779 (April 2007) Ventilation for non residential buildings — Performance requirements for ventilation and room conditioning systems **CONTENT:** Gives performance requirements for ventilation systems. Applies to the design of ventilation and room conditioning systems for non-residential buildings subject to human occupancy, excluding applications like industrial processes.(Applications for residential ventilation are dealt with in EN 14788.)
Section 4C - Standards to support the above - Overheating and solar protection
EN-ISO 13791 (2004) Thermal performance of buildings — Calculation of internal temperatures of a room in summer without mechanical cooling — General criteria and validation procedures. **CONTENT:** Specifies the assumptions, boundary conditions, equations and validation tests for a calculation procedure, under transient hourly conditions, of the internal temperatures (air and operative) during the warm period, of a single room without any cooling/heating equipment in operation. No specific numerical techniques are imposed by this standard. Validation tests are included.
EN-ISO 13792 (2005) Thermal performance of buildings — Calculation of internal temperatures of a room in summer without mechanical cooling — Simplified methods **CONTENT:** Specifies the required input data for simplified calculation methods for determining the maximum, average and minimum daily values of the operative temperature of a room in the warm period, to define the characteristics of a room in order to avoid overheating in summer at

the design stage, or to define whether the installation of a cooling system is necessary. Gives criteria to be met by a calculation method in order to satisfy the standard
EN 13363-1+A1 Solar protection devices combined with glazing — Calculation of solar and light transmittance — Part 1: Simplified method **CONTENT:** Specifies a simplified method based on the thermal transmittance and total solar energy transmittance of the glazing and on the light transmittance and reflectance of the solar protection device to estimate the total solar energy transmittance of a solar protection device combined with glazing. Applicable to all types of solar protection devices parallel to the glazing. Venetian or louvre blinds are assumed to be adjusted so that there is no direct solar penetration.
EN 13363-2 Solar protection devices combined with glazing — Calculation of total solar energy transmittance and light transmittance — Part 2: Detailed calculation method **CONTENT:** Specifies a detailed method, based on the spectral transmission data of the materials, comprising the solar protection devices and the glazing, to determine the total solar energy transmittance and other relevant solar-optical data of the combination. Valid for all types of solar protection devices parallel to the glazing. Ventilation of the blind is allowed for in each of these positions in determining the solar energy absorbed by the glazing or blind components, for vertical orientation of the glazing.
Section 4D - Standards to support the above - Indoor conditions and external climate
CR 1752 Ventilation for buildings — Design criteria for the indoor environment **CONTENT:** Specifies the requirements for, and the methods for expressing the quality of the indoor environment for the design, commissioning, operation and control of ventilation and air-conditioning systems. Covers indoor environments where the major concern is the human occupation, but excludes dwellings and buildings where industrial processes or similar operations requiring special conditions are undertaken.
EN 15251 (May 2007) Indoor Environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality thermal environment, lighting and acoustics **CONTENT:** Specifies the parameters of impact and/or criteria for indoor environment and how to establish indoor environmental input parameters for the building system design and energy performance calculations. Also specifies methods for long term evaluation of the obtained indoor environment as a result of calculations or measurements. Applicable mainly in the non-industrial buildings where the criteria for indoor environment are set by human occupancy and where the production or process does not have a major impact on indoor environment.
EN ISO 15927-1 Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 1: Monthly means of single meteorological elements (ISO 15927-1:2003) **CONTENT:** Specifies procedures for calculating and presenting the monthly means of those

parameters of climatic data needed to assess some aspects of the thermal and moisture performance of buildings. Covers air temperature; atmospheric humidity wind speed; precipitation; solar radiation; long wave radiation.

EN ISO 15927-2

Hygrothermal performance of buildings — Calculation and presentation of climatic data s — Part 2: Hourly data for design cooling load (ISO 15927-2:2009)

CONTENT: Gives the definition and specifies methods of calculation and presentation of the monthly external design climate to be used in determining the design cooling load of buildings.

EN ISO 15927-3

Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 3: Calculation of a driving rain index for vertical surfaces from hourly wind and rain data (ISO 15927-3:2009)

CONTENT: Specifies a procedure for analysing hourly rainfall and wind data derived from meteorological observations so as to provide an estimate of the quantity of water likely to impact on a wall of any given orientation, taking account of topography, local sheltering and the type of building and wall.

EN ISO 15927-4

Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 4: Hourly data for assessing the annual energy use for heating and cooling (ISO 15927-4:2005)

CONTENT: Specifies a method for constructing a reference year of hourly values of appropriate meteorological data suitable for assessing the average annual energy for heating and cooling.

EN ISO 15927-5

Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 5: Data for design heat load for space heating (ISO 15927-5:2004)

CONTENT: Specifies the definition, method of calculation and method of presentation of the climatic data to be used in determining the design heat load for space heating in buildings, including the winter external design air temperatures, and the relevant wind speed and direction, where appropriate.

EN ISO 15927-6

Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 6: Accumulated temperature differences (degree days) (ISO 15927-6:2007)

CONTENT: Specifies the definition, method of computation and method of presentation of data on accumulated temperature differences, used for assessing the energy used for space heating in buildings.

Section 4E - Standards to support the above - Definitions and terminology

EN ISO 7345

Thermal insulation — Physical quantities and definitions (ISO 7345:1987)

CONTENT: Defines physical quantities used in the field of thermal insulation, and gives the corresponding symbols and units.
EN ISO 9288 Thermal insulation — Heat transfer by radiation ⎸ Physical quantities and definitions (ISO 9288:1989) **CONTENT:** Defines physical quantities and other terms in the field of thermal insulation relating to heat transfer by radiation.
EN ISO 9251 Thermal insulation — Heat transfer conditions and properties of materials — Vocabulary (ISO 9251:1987) **CONTENT:** Defines terms used in the field of thermal insulation to describe heat transfer conditions and properties of materials.
EN 12792 Ventilation for buildings — Symbols, terminology and graphical symbols **CONTENT:** Comprises the symbols and terminology included in the European standards covering 'Ventilation for buildings' produced by CEN/TC 156.
Section 5 - Standards concerned with monitoring and verification of energy performance
EN 12599 Ventilation for buildings — Test procedures and measuring methods for handing over installed ventilation and air conditioning systems **CONTENT:** Specifies checks, test methods and measuring instruments in order to verify the fitness for purpose of the installed systems at the stage of handing over. Offers choice between simple test methods and extensive measurements. Applies to mechanically operated ventilation and air conditioning systems as specified in EN 12792 and comprising any of the following: – Air terminal devices and units – Air handling units – Air distribution systems (supply, extract, exhaust) – Fire protection devices – Automatic control devices. Does not define the procedure by which the system is set, adjusted and balanced or the procedure for internal quality control checks before handing over.
EN 13829 Thermal performance of buildings — Determination of air permeability of buildings — Fan pressurization method (ISO 9972:1996, modified) **CONTENT:** Measurement of the air permeability of buildings or parts of buildings in the field. It specifies the use of mechanical pressurization or depressurization of a building or part of a building. It describes the measurement of the resulting air flow rates over a range of indoor-

outdoor static pressure differences.
EN ISO 12569 Thermal insulation in buildings — Determination of air change in buildings — Tracer gas dilution method (ISO 12569:2000) **CONTENT:** Describes the use of tracer gas dilution for determining the air change in a single zone as induced by weather conditions or mechanical ventilation. Includes concentration decay, constant injection and constant concentration.
EN 13187 Thermal performance of buildings — Qualitative detection of thermal irregularities in building envelopes — Infrared method (ISO 6781:1983 modified) **CONTENT:** Specifies a qualitative method, by thermographic examination, for detecting thermal irregularities in building envelopes. The method is used initially to identify wide variations in thermal properties, including air tightness, of the components constituting the external envelopes of buildings. The results have to be interpreted and assessed by persons who are specially trained for this purpose.
EN 15378 (Sept. 2007) Heating systems in buildings — Inspection of boilers and heating systems **CONTENT:** Specifies inspection procedures and optional measurement methods for the assessment of energy performance of existing boilers and heating systems. Includes boilers for heating, domestic hot water or both; and boilers fired by gas, liquid or solid fuel (including biomass). Also includes heat distribution network, including associated components and controls; heat emitters, including accessories; and space heating control system.
EN 15239 (May 2007) Ventilation for buildings — Energy performance of buildings — Guidelines for the inspection of ventilation systems **CONTENT:** Gives methodology for the inspection of mechanical and natural ventilation systems in relation to its energy consumption. Applicable to all buildings. Purpose is to assess functioning and impact on energy consumption. Includes recommendations on possible system improvements
EN 15240 (April 2007) Ventilation for buildings — Energy performance of buildings — Guidelines for the inspection of air-conditioning systems **CONTENT:** Describes the common methodology for inspection of air conditioning systems in buildings for space cooling and or heating from an energy consumption standpoint. The purpose is to assess the energy performance and proper sizing of the system, including: conformity to the original and subsequent design modifications, actual requirements and the present state of the building; correct system functioning; function and settings of various controls; function and fitting of the various components; power input and the resulting energy output

Annex B – More on the role and status of the CEN standards; frequently asked questions

How is the CEN work organised?

CEN is the European Association of national standardisation institutes, the so called National Standards Bodies (NSB's). These NSB's are responsible for the contact with the interested market parties and experts preparing the CEN standards in the same way they do when preparing national standards. Members of CEN-Technical Committees (CEN-TC's) are nominated by the NSB's. The TC's decide on the scope and content of a standard. The actual work is done in smaller CEN-TC-Working Groups whose expert members are nominated by NSB's. In most countries the NSB organises a national mirror group to monitor and support the work of a CEN-TC. This was also done in the EPBD program of CEN. Because in this case the work covers 5 CEN-TC's, some NSB's organised a special mirror group to follow the work on the total EPBD CEN program.

Members who participate to CEN-TC-WG's are involved in the details of the standard development. They should contribute themselves, as expert, and be motivated to find the right expertise in their own network.

Once a draft standard is approved by the responsible CEN-TC, it goes out as draft standard ("prEN") for Public Enquiry. The comments are prepared via the NSB's. The working group prepares the replies to the comments and prepares a new draft standard which, once approved again by the CEN-TC goes out as final draft for Final Vote. The time between publishing the prEN and publishing the final standard is usually between 21 and 30 months.

How and where do I obtain EN standards?

EN's or prEN's (draft EN's) or EN-ISO standards are officially published by CEN in Brussels but can only be obtained from the NSB's. The CEN website provides the contacts and has also a search engine to see which standard activities are in progress and the existing and draft standards available.

Are they only available in English?

It is a fact that in general most of the preparatory work in the TC's and WG's is in English. The underlying documentation, the preliminary drafts, are in English. When publishing a draft standard (prEN) it is up to DIN and AFNOR to decide if they want to translate and provide CEN with a German or French version. The time schedules allow for 2 months making this translation available. It is up to the NSB's to decide if other national language versions will be produced. This decision will only be taken if this is required by the users. If this group is a small expert group of, for example, software developers this seems not likely. But when the standard is referred in a more general way for a bigger target group, translation should be considered by the NSB.

What is the relation with the national and international (ISO) standards?

National standards

There is an agreement between CEN and the national standards bodies that before starting national standardisation work CEN standardisation work shall be considered. If there is already CEN work started, this line shall be followed and national work should not be done. It is called a "Stand still". After the EN's are published, existing and possibly conflicting national standards shall be withdrawn within a certain time frame. If national legislation is referring to these national standards, the NSB can get some years to repair this. A three to five years period is considered as the maximum deviation period in which national standards shall be withdrawn.

ISO standards

There is an agreement between CEN and ISO saying that they shall not work on the same Work Items. New work can only be started in CEN if it is not already on the ISO program and reverse. CEN-TC's are encouraged to seek contact with related ISO-TC's , e.g. CEN-TC89 and ISO-TC163, to agree on possible parallel voting. This means that the EN may become an ISO-EN if accepted by ISO. Existing EN's will by preference be maintained by related ISO-TC's. Only when related ISO-TC's are not interested or not giving it enough priority, the CEN-TC will continue the normal 5 years maintenance schedule or faster if needed.

Harmonisation

To support the open EU market, more and more standards have been prepared as EN's. For building products this is even a requirement based on EU mandates to CEN according to the EU-CPD (Construction Product Directive). To stimulate an open EU market, construction products shall only be specified according to mandatory, socalled "harmonised" EN (or EN-ISO) standards.

The EPBD stimulates EN standards for the energy calculation procedures for buildings and their systems, and all related performance prescriptive standards needed to specify buildings and systems in relation to the Energy Performance of Buildings Directive. The European Commission gave a mandate to CEN in order to speed up the development of standards needed for the EPBD implementation.

CEN didn't start this work from scratch. Already existing CEN Technical Committees have been quite active during the last 15 years preparing international standards in this field. These TC's have been involved in developing the CEN program to support the implementation of the EPBD.

The process was overseen by CEN/BT WG 173, Energy performance of buildings project group (currently: CEN/BT TC 371). It's task was to coordinate the work and to ensure that standards prepared in different committees interface with each other in a suitable way.

The EU Mandate to CEN

The European Commission decided after consultation of the Member States experts, interest groups and CEN, that there was an urgent need for standards to support the EPBD. The aim is to offer within a short period (2004-2006) a clear and consistent set of standards as basis for the national procedures in the Member States. In particular the Member States with a very limited experience in the field of the EPBD could benefit from this.

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 NSB's have to do this on their own. In addition, there is great advantage in having harmonised standards throughout Europe. The widescale 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 development of CEN standards may lead to CEN-ISO standards. The ISO standards are widely accepted and may even increase the market opportunities of the European industry.

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.

What is in the set of EPBD CEN Standards?

The set of CEN-EPBD standards consists of 43 titles or parts and can be grouped as follows:

The building physics standards, e.g. describing the calculation of heat transfer by transmission and ventilation, load and summer temperature, solar transmittance and the calculation of the energy need for heating and cooling of the building.

In the second group there are standards on the description and properties (classification) of ventilation systems plus cooling and air conditioning systems.

The third group is focussing on the description of space heating and domestic hot water systems:

- The generation efficiency.
- The emission efficiency.
- Domestic hot water systems.
- Low temperature heating and cooling systems integrated in building elements (embedded systems).

A series of supporting standards on:

- Lighting systems for buildings (including the effect of daylight)
- Controls and automation for building services
- Classification of the indoor environment
- Financial economic evaluation of sustainable energy applications.

A set of standards on inspection:

- Boilers and heating systems
- Cooling- and AC systems
- Ventilation systems.

And, last but not least, the two key standards on expressing energy performance and for energy certification of buildings, the overall energy use, primary energy and CO_2 emissions, the assessment of energy use and definition of energy performance ratings.

What is the current status of the EPBD CEN standards and where can I obtain these?

All CEN standards (EN or EN-ISO) and draft standards (prEN or prEN-DIS) can be ordered from the National Standards Body organisation (NSB) (see www.cen.eu).

All EPBD CEN standards were published in 2007 or 2008, as EN or EN-ISO standards.

The total set contains 2000 pages. As usual, EN's are published in English and, by choice of DIN and AFNOR, also published in a German or French version. It is up to the other NSB's to decide if national language versions will be produced, depending on the target group as explained above.

The EPBD related CEN standards - "How many pages did you say?"

This is the very understandable first response from people if they hear that the EPBD related CEN standards cover maybe 2000 pages.

"*That cannot be a practical procedure.*"

Without denying the positive aspect of reducing the number of pages, it should be clear that the package of standards covers a wide variety of types, with different types of users.

For instance:

- Part of the package consists of reference methods or validation methods, to develop or test simple methods or software tools for certain elements of the calculation
- Other parts provide the thermal or solar component properties, which are already mandatory under the European Construction Product Directive (CPD) and in many cases produce results that are 'plug-and-play' for the EPBD user.
- Similarly, several standards or parts of standards provide assessment procedures for specific system elements.
- Moreover, the standards contain many very useful informative annexes and examples.
- In addition, most procedures will be converted into software.

Finally, each standard or part of a standard is a complete document, including title page, content, foreword, introduction, scope, normative references, terms and definitions and symbols.

What about "Keep It Simple"?

In addition to the previous remarks, it is also important to note the following with respect to the volume of the CEN standards:

Many of the procedures play a role in the context of **building regulations**, with legal implications (see also the Buildings Platform Information Papers P25 and P26 which also can be downloaded from the project website). This requires extra attention to avoid ambiguity.

The standards should also play a role in the promotion of **innovative products and technologies**. Where possible, the procedures already include assessment procedures for innovative techniques, if already sufficiently established to agree on the procedures and conditions. Less common and usually more complex techniques require a more extensive description.

National standards

National energy performance standards may be much shorter:

Because/if only specific options are chosen from the CEN standards for national application.

National standards will refer implicitly or explicitly to several of the CEN or EN ISO standards, e.g. ranging from the thermal resistance or solar transmittance of building envelope elements, to e.g. efficiency of ventilation heat recovery units.

If applicable, when using default values for certain assumptions, national standards will refer to reference CEN methods, used during the pre-processing phase to produce national coefficients or tabulated data.

Are all standards available?

They can be ordered during the Formal Vote (FV) period. In that case a draft standard, or if the standard is still in the CEN pipeline a prEN or prEN ISO version, will be provided. After the FV, the official final version can be ordered from the National Standard Body (NSB).

Note that after final approval it may take a few months longer before the National Standard Body is able to deliver the national version. This version will always have a national cover where the logo and name and abbreviation of the NSB and the title in the national language is added. Example: in the Netherlands, the EN15217 will be indicated as NEN EN 15217.

In which languages are the CEN standards available?

It may be that although the National Standard Body produced a national language version, the standard will always be available in English (the official text), in many cases also a French and German version may be available. The French language versions can be ordered from AFNOR and other CEN countries where French is the official language, the same for the German versions, they can be ordered from DIN, ON, etc.

Are the standards delivered as paper documents or as PDF?

This is up to the National Standard Body, most countries offer both possibilities.

Why isn't it possible to download these standards from a website (e.g. www.iee-cense.eu)?

Standards are copyright protected property of the publisher (CEN , ISO etc.) and not part of the public domain.

What to do if I have questions about the use or technical content of the standard?

In general questions on standards could be answered by the National Standard Body helpdesk,. They may also refer you to their national experts who have been involved in the preparation of the standard on a national or international level.

For the EPBD standards the BUILD UP website (www.buildup.eu, from early May 2009) has a FAQ section and will offer a possibility to raise matters and participate in discussions. Your feed back (e.g. comments and suggestions) is also highly appreciated at the CENSE website (www.iee-cense.eu) .

What is the relation between the EPBD and the developed CEN standards?

The developed standards reflect the requirements of the EPBD as given in the different articles and the annex. The procedures as given in the standards meet the essential requirements as set out by the EPBD. Note that the EPBD is an example of the application of the principles of subsidiarity and proportionality: general principles are established at Community level, but the detailed implementation are left to Member States, thus allowing each Member State to choose the regime which corresponds best to its particular situation.

Why is the use of the CEN-EPBD standards not mandatory for Member States? This could be expected as the EPBD is an European Directive?

General

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). 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. 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.

Legal arguments

The EPBD has stimulated the more rapid development of CEN standards (ENs) for energy calculation procedures for buildings and their systems, and the related standards that are needed to specify buildings and systems performance in accordance with the Directive. The European Commission issued a mandate to CEN in order to speed up the development of standards needed for implementation of the EPBD.

In the case of the **Construction Products Directive (CPD)**, the European Commission issues mandates to CEN to make use of CEN standards mandatory for all Member States.

In contrast with the CPD, the **EPBD** allows national and regional differentiation: the European Commission is responsible for generating a common framework (the Directive) in the field of energy efficiency in the building sector. The implementation of the framework and the definition of requirements and procedures is within the exclusive jurisdiction of each Member States (subsidiary principle). The Member States are not bound to use any standard in their regulations. The implemented procedures can be fully covered in the national laws without reference to national or European standards.

Practical arguments

From a practical point of view, within the given short timescale (2004-2007) it was impossible to produce a set of approved and published standards to be implemented in the Member States before the national implementation of the EPBD (which began in 2006).

Consequently, Member States, in the preparation of national legislation, had to refer to either existing or new national procedures.

In addition, at the time of writing the CEN standards, only a limited number of countries had practical experience with procedures for assessing the integrated energy performance of buildings that could be used in national building regulations. Several of the CEN standards reflect this situation by allowing different options to be decided at national level.

Nevertheless, most Member States are planning to adopt the CEN standards in one way or another within a few years.

The CENSE project organizes the information on the CEN standards and the feed back from the Member States.

What are the future prospects for the status of the CEN standards?

We expect a further harmonization in the near future. In particular when feedback from the Member States and other target groups has lead to recommendations for improvement of the CEN standards and when these recommendations have been implemented in updated versions of the standards in a few years from now.

The CENSE project may play an important role in identifying and removing the barriers and to promote examples of good practice.

Why is standardization at EU level so important?

Today most companies (consultants, manufacturers and contractors) work internationally. From their point of view it is preferable to have internationally accepted calculation methods and input data for the energy efficiency of buildings and building systems.

European standards should therefore form the basis of any revision of national building codes. The CENSE project will interact with all partners (building code writers, consultants, manufacturers, educational institutions, etc.).

The point is to establish a two-way communication:

- CENSE will provide information about the “European Method” and explain the background and use of the standards.

- CENSE will gather information on any obstacles that are encountered and provide examples of good practice for use when applying the standards, in dialogue with the Member States and other stakeholders and will provide feedback to CEN for a any revision of the standards.

So will the future be one harmonized set of CEN procedures to assess and express the energy performance of buildings?

That would be ideal from the point of view of harmonization.

However, we still have to see to what extent regional differences in Europe require differentiation of input data and boundary conditions.

This has to do with differing climates, building traditions (types of new and existing buildings, types of skill) and the economic and social climate (user behaviour, availability of products and skills), legal settings and quality assurance.

It may also have to do with related national or regional requirements.

To name a few:

- indoor air quality (e.g. which affects the input data for ventilation rates),

- summertime comfort (e.g. which affects the input data for temperature set points),

- usability of indoor spaces (e.g. which affects the classification of an attic as a storage space or as a study or bedroom).

It will be very interesting and important to learn to what extent such differentiation will constitute an obstacle for trans-border transparency, in particular for the comparison between Member States of the energy performance of buildings.

Are the products, building products and systems, taken into account in the EPBD standards?

The energy performance of products is taken into account in an indirect way. The EPBD CEN standards are generally dealing with performance description of buildings and systems. The EPBD standards describe the way the system performance has to be determined. These values are influenced by the relevant product specifications. The standards developed under the EPBD either refer to relevant product standards or specify the required input for the system standards.

How can I make the energy performance of systems visible on the Energy performance certificate (the energy label)?

This is possible if not only the overall energy performance (in MJ or kWh), but also the system energy performance is reported separately. The same goes for the local production of renewable energy. EN 15603 describes how this could be done. Given the different lifespan of building elements and building systems separate consideration would be beneficial.

Is there a roadmap or guidance to achieve one European calculation method?

There is a consensus within Europe that the built environment has a major task to reduce the CO_2 emissions and convert to sustainable energy systems. The energy saving targets are high and there is a need to show in a non controversial way the achievement of the various Member States. This is one of the reasons that harmonised calculation procedures, including harmonised input parameters, are desirable. However there are still a lot of national differences in the various regulations directly influencing the EP requirement level; for example the requirements on ventilation or other health related issues. The EN 15251 “Indoor Environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality thermal environment, lighting and acoustics “ has been developed to give the MS regulators the opportunity to harmonise these requirements.

Are the common definitions given in CEN/TR 15615 mandatory?

CEN/TR 15615 is not a standard, but a technical report and therefore the definitions (annex C) are not mandatory. However, most of the definitions are adopted also in the European standard EN 15603, which is one of the key standards in the set of standards to support the EPBD. It is intended that the annexes C and D of CEN/TR 15615 will form the basis of a future trilingual standard covering common definitions and symbols for energy calculations. Most Member States are planning to adopt the CEN standards in one way or another within a few years.

Are the common symbols given in CEN/TR 15615 mandatory?

CEN/TR 15615 is not a standard, but a technical report and therefore the common symbols and subscripts (annex D) are not mandatory. It is however strongly recommended to use these common symbols and subscripts also in translated national standards and other related national documents. It is intended that the annexes C and D of CEN/TR 15615 will form the basis of a future trilingual standard covering common definitions and symbols for energy calculations. Most Member States are planning to adopt the CEN standards in one way or another within a few years.

Why are the symbols in some of the EN ISO standards related to the EPBD not always the same as in the CEN standards to support the EPBD?

For instance: in EN ISO 13789 the subscripts for transmission and ventilation are $_T$ and $_V$ in ISO and $_{tr}$ and $_{ve}$ in CEN.

There may be two reasons:

1) because the EN ISO standard was already published before the common symbols were agreed upon in CEN (which was in 2007);

2) because the ISO standard is closely linked to other ISO standards which use different symbols.

Annex C – Project summary

Acronym

CENSE

Title

IEE-CENSE. Leading the CEN Standards on Energy performance of buildings to practice.
Towards effective support of the EPBD implementation and acceleration in the EU Member States

Objective

To accelerate the adoption and improved effectiveness of EPBD-related building energy performance standards in EU Member States

Benefits

Increased accessibility, efficiency and harmonisation of building energy performance assessments in the MS

Main activities

— To communicate the role, status and content of these standards as widely as possible and to provide guidance on their implementation.

— To collect comments and examples of good practice from MS, so as to remove obstacles to implementation, and to collect and secure results from relevant SAVE and FP6 projects.

— To prepare recommendations to CEN.

Duration

The project duration is from October 2007 until March 2010.

Partners

The partners in the project (from eight different countries) are all experts who are active in CEN-EPBD. They combine this expertise with knowledge and experience of implementation at the national level.

Partners:

Organisation	Country	Persons	Website
TNO (coordinator)	The Netherlands	Berrie van Kampen (Operational management) Dick van Dijk (Project coordination) Hans van Wolferen Marleen Spiekman	www.tno.nl
CSTB	France	Johann Zirngibl Jean Robert Millet Hicham Lahmidi Claude Francois	www.cstb.fr
ISSO	The Netherlands	Jaap Hogeling Kees Arkesteijn	www.isso.nl
Fraunhofer - IBP	Germany	Hans Erhorn Anna Staudt Jan de Boer	www.ibp.fraunhofer.de
DTU	Denmark	Bjarne Olesen Peter Strøm-Tejsen	www.ie.dtu.dk
ESD	United Kingdom	Robert Cohen	www.esd.co.uk
FAMBSI	Finland	Jorma Railio	www.fambsi.fi
EDC	Italy	Laurent Socal	www.edilclima.it

Associated partners:

Organisation	Country	Persons	Website
HTA Luzern	Switzerland	Gerhard Zweifel	www.hslu.ch
BRE	United Kingdom	Roger Hitchin Brian Anderson	www.bre.co.uk
Viessmann	Germany	Jürgen Schilling	www.viessmann.de
Roulet	Switzerland	Claude-Alain Roulet	www.epfl.ch
JRC (IES)	Eur.Commission	Hans Bloem	ies.jrc.ec.europa.eu

Expected results

— A website with guidance documents for the CEN standards.

— Common trends, obstacles identified, possible solutions and examples of good practice concerning the use of the CEN standards.

— Recommendations for further harmonisation.

The project reports, presentations and discussions with target groups will result in increased awareness and knowledge on the content and the usefulness of these European standards and to shared experiences between the Member States (building code and standard writers) and other major target groups (design engineers and installation engineers, manufacturers).

CENSE Information Papers in cooperation with the EPBD Buildings Platform

One of the most effective ways to disseminate information on the CEN standards, which also serves to trigger feedback from the target groups, is by so-called Information Papers.

As a result of cooperation with the EPBD Buildings Platform, these Information Papers are based on the general template for Buildings Platform Information Papers and are made available at the Buildings Platform website, along with other Information Papers related to the EPBD.
From summer 2009 the Buildings Platform will be succeeded by: **www.buildup.eu**.

Examples of information papers from the CENSE project: