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Information paper on the common definitions and common symbols for EPBD related CEN standards

Given in CEN Technical report CEN/TR 15615 ('Umbrella Document')

This paper gives a short introduction to the two annexes in the CEN Technical Report CEN/TR 15615, *Explanation of the general relationship between various European standards and the Energy Performance of Buildings Directive (EPBD) - Umbrella Document*. CEN/TR 15615 describes the European standards (ENs) that are intended to support the EPBD.

It focuses on Annex C of that report, which provides a list of definitions, and Annex D, which provides a list of principal symbols, that are used consistently in the CEN standards to support the EPBD.

1 > Scope of the CEN Technical Report

The CEN Technical Report CEN/TR 15615 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 of this Technical Report the standards concerned are arranged in a hierarchical fashion. Section 1 of Annex A lists standards concerned with overall energy performance in support of Articles 4 to 7 of the Directive. Sections 2 to 5 list the standards relating to specific aspects or modules of building energy performance which contribute to the overall calculation. 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. It is intended that these annexes will form the basis of a future trilingual standard covering common definitions and symbols for energy calculations.

2 > Background

Introduction

Many of the CEN standards to support the EPBD 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, et cetera).

A few examples of the (in total more than 100) common definitions (see chapter 3 of this paper):

C.1.4

technical building system

technical equipment for heating, cooling, ventilation, domestic hot water, lighting and electricity production

NOTE 1 A technical building system can refer to one or to several building services (e.g. heating system, heating and DHW system).

NOTE 2 A technical building system is composed of different sub-systems.

NOTE 3 Electricity production can include cogeneration and photovoltaic systems.

C.1.22

conditioned space

heated and/or cooled space

NOTE The heated and/or cooled spaces are used to define the thermal envelope.

C.2.6

heat recovery

heat generated by a technical building system or linked to a building use (e.g. domestic hot water) which is utilised directly in a related system to lower the heat input and which would otherwise be wasted (e.g. preheating of the combustion air by a flue gas heat exchanger)

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 1 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. 1. Tower of Babel or towards common definitions?!

Definitions

Consequently, one of the important actions 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 the drafting of the standards. The coordinating task force in CEN, CEN/BT TF 173 (currently called CEN/BT TC 371) was responsible for this action. The action focussed on harmonization of terms used in the top level standards.

Symbols

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.

A few more examples of the (in total more than 100) common definitions (see chapter 3 of this paper):

C.5.1, energy performance of a building

calculated or measured amount of weighted net delivered energy actually used or estimated to meet different needs associated with a standardised use of a building, which may include, inter alia, energy used for heating, cooling, ventilation, domestic hot water and lighting

C.5.2, energy performance requirement

minimum level of energy performance that is to be achieved to obtain a right or an advantage: e.g. right to build, lower interest rate, quality label

C.5.3, energy rating

evaluation of the energy performance of a building based on the weighted sum of the calculated or measured use of energy carriers

3 > Common definitions

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 2, is adopted as annex C of CEN/TR 15615, the "Umbrella Document". A few examples are given in the left insert.

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.

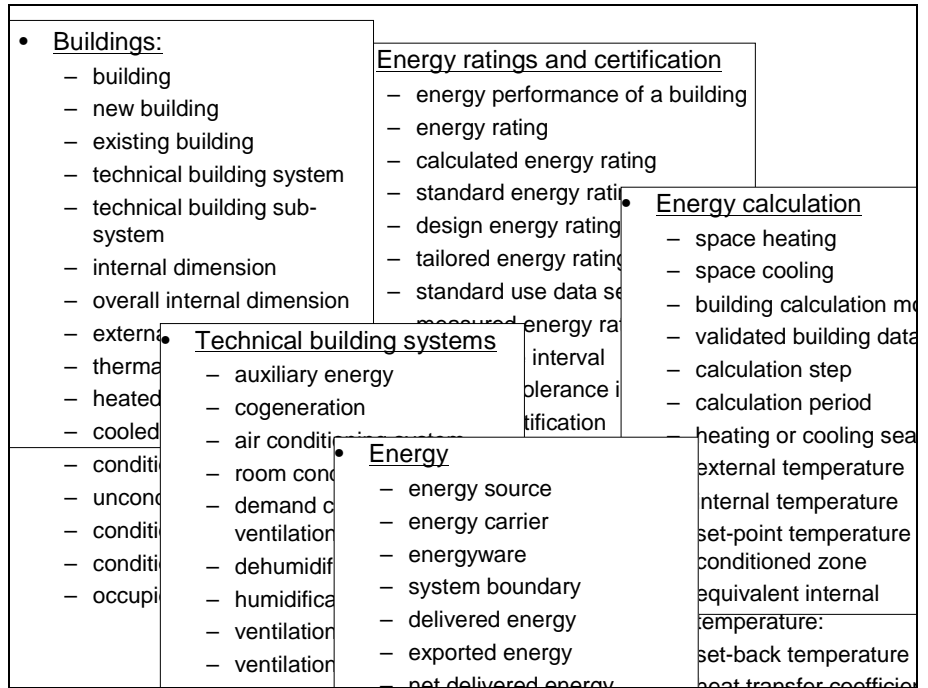


Fig. 2. Illustration of the kind of terms included in the common definitions

4 > Common symbols and subscripts

Introduction

In addition to the common definitions, a list of common symbols and subscripts was prepared for the main physical quantities that are commonly used in the top level standards.

The selected symbols only concern data passed from one standard to another. Additional symbols and units may be used locally within each standard, but it is strongly recommended to use the common symbols, subscripts and order.

The list, introduced below, is adopted as annex D of CEN/TR 15615, the "Umbrella Document". A few examples are given in the left insert.

The following table shows some examples of common symbols from CEN/TR 15615.

Table 1 – Common symbols, some examples

Symbol	Quantity	Unit	Symbol	Quantity	Unit
<i>A</i>	area	m ²	<i>Q</i>	quantity of heat	J ^a
<i>C</i>	heat capacity	J/K ^a	<i>q</i>	volumetric airflow rate	m ³ /s
<i>c</i>	specific heat capacity	J/(kg·K) ^a	<i>q</i>	heat flow density	W/m ²
<i>E</i>	energy in general; including primary energy, energy carriers (except heat, auxiliary electricity and work)	kg, m ³ , J ^a ^b	<i>t</i>	time, period of time	s ^a
<i>EP</i>	energy performance indicator	J/(m ² ·a) ^a , kg/(m ² ·a), €/m ² ·a) ^c	<i>W</i>	(electrical) auxiliary energy	J ^a
<i>I</i>	solar irradiance	W/m ²	<i>η</i>	efficiency factor	-
<i>m</i>	mass (e.g. quantity of CO ₂ emissions)	kg	<i>θ</i>	Celsius temperature	°C
<i>P</i>	power in general including electrical power	W	<i>Φ</i>	heat flow rate, thermal power	W

^a Hours (h) may be used as the unit of time instead of seconds for all quantities involving time (i.e. for time periods as well as for air change rates), but in that case the unit of energy is Wh instead of J.

^b The unit depends on the type of energy carrier and the way its amount is expressed.

^c The unit depends on the indicator chosen, see EN 15217 clause 5.

Subscripts

The main subscripts are provided in four successive levels.

It goes from the general to the detailed:

- > the first level is related to the use,
- > the second is related to the main topics influencing the energy performance (energy carrier, heat transfer building envelope, technical building system),
- > the third is related to energy balance items or it qualifies the higher level,

At each level there may be different sets of subscripts, for different contexts. For example: in a certain context a distinction is required between type of energy use (heating versus cooling versus ventilation, etc.), while in another context a distinction is needed between the energy carrier (gas versus oil versus electricity versus...). But a distinction is never required between energy use for heating versus gas.

The levels are hierarchic, to harmonise the order of the subscripts used in different standards.

NOTE For example: recoverable ventilation system losses:

good: $Q_{V,sys,ls,rcb}$

wrong: $Q_{ls,V,rcb}$

Because of its importance in helping to make the CEN standards accessible, transparent and consistent, the full table of these four levels from CEN/TR 15615 is given in the annex to this paper.

Use of the common symbols and subscripts in other languages:

In CEN/TR 15615 the terms for the common symbols and subscripts are also translated into French and German.

It is strongly suggested to use the same symbols and subscripts in translated national standards and/or related (national) documents, with the English expression given as additional information, to explain the origin of the abbreviation.

Table 2. A few examples of the common symbols used in another language (from Dutch OntwNEN 7120):

Symbol	Grootheid	Eenheid	Engelse oorsprong
A	Oppervlakte	m ²	Area
H	warmteoverdrachtscoëfficiënt	W/K	Heat transfer coefficient
R	warmteweerstand	M ² K/W	Thermal resistance

Table 3. A few examples of the common subscripts used in another language (from Dutch OntwNEN 7120 and from Italian UNI/TS 11300-1)

Index	Betekenis	Engelse oorsprong
del	aangeleverd	delivered
C	Koeling (energiegebruik voor ~)	Cooling (energy use for ~)
gen	Opwekking	Generation

Pedici		Pedici	
g	terreno	set	regolazione
gl	vetro	sh	ombreggiatura, schermatura
gn	aporti termici	shut	Chiusura oscurante

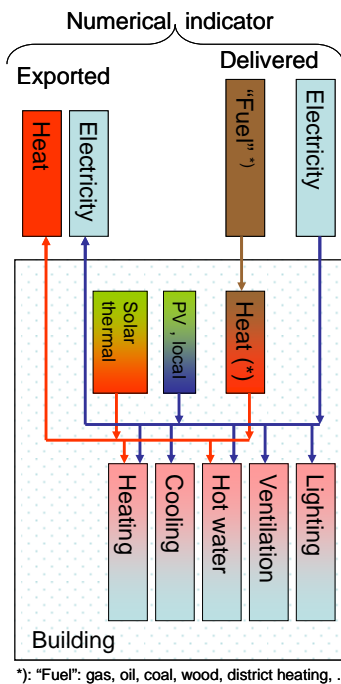


Fig. 3: Diagram illustrating the energy delivered to and exported from a building site

5 > Building boundaries

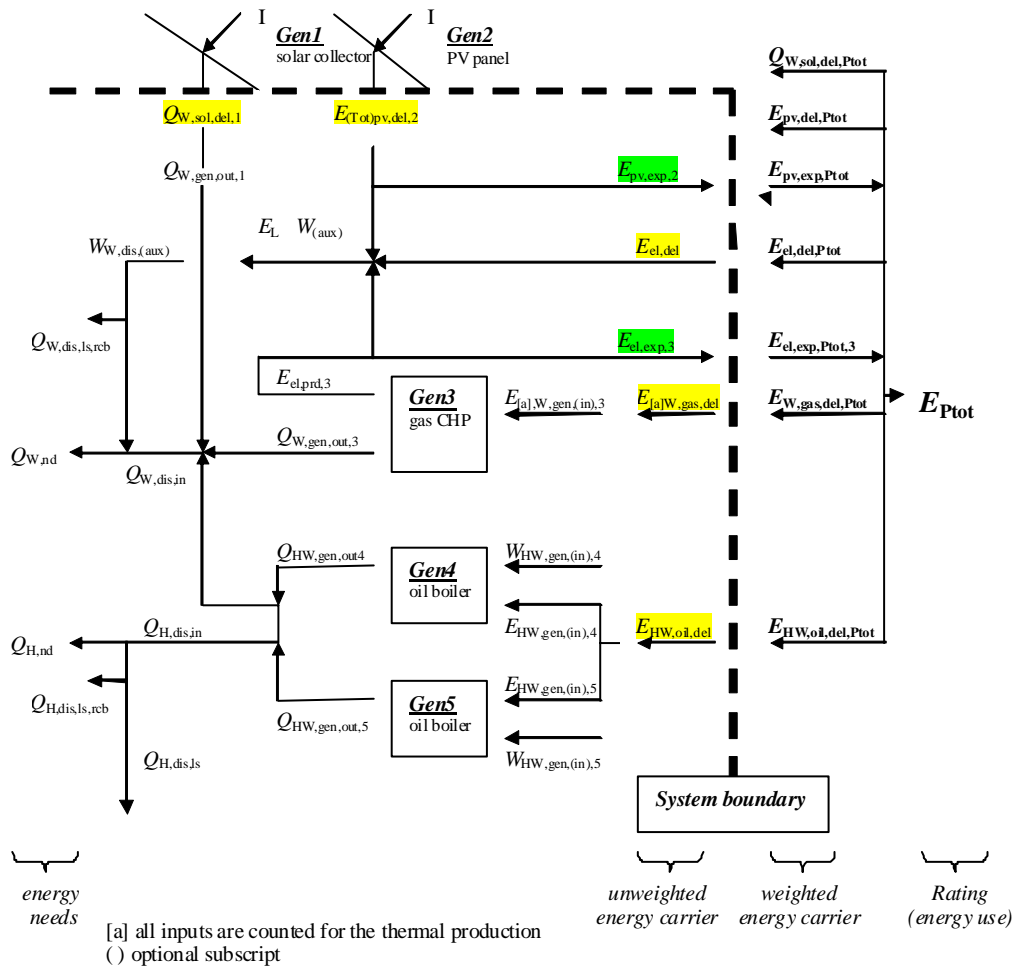
One of the crucial elements in the definitions is the boundary of the building, including its technical building systems. Although the detailed procedures to define this boundary are set at national level, CEN provides common rules. Within the boundary a distinction is made between the building needs and the thermal losses of the technical building systems. The recoverable part of these losses may lead to an interaction with the building needs. Energy is delivered from outside the boundary by energy carriers, such as gas, electricity or heat. Additionally, renewable energy can be produced within its boundary. Optionally, energy can also be exported to outside, in the form of electricity and/or heat. More details can be found in the CENSE Information Paper P87 ("How to integrate the CEN-EPBD standards in national building regulations? The use of EN 15603 to adopt the same structure as starting point for coordination of Member States regulations").

6 > Example

The following example shows a technical building system where the symbols and subscripts are applied and where the building boundary is clearly indicated.

The example is only to illustrate the uses of the symbols, the delivered and exported energy carriers and the rating (energy use). Not all losses, auxiliaries, etc are indicated.

- > Gen1: Solar collector producing only DHW
- > Gen2: Photovoltaic panel exporting partly the electricity produced
- > Gen3: Gas driven cogeneration unit for DHW production and exporting partly the electricity produced
- > Gen4: Oil fired boiler for heating and DHW
- > Gen5: Oil fired boiler for heating and DHW



Energy crossing the building boundary:

Outgoing: Exported energy (green)

Incoming: Delivered energy (yellow)

Fig. 4. Illustration of the application of the common symbols on a technical building system

7 > FAQ

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 τ and ν in ISO and τ_r and ν_e 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.

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8 > References

1. CEN/TR 15615: Explanation of the general relationship between various European Standards and the Energy Performance of Buildings Directive (EPBD) - Umbrella Document. European Committee for Standardization (CEN), Brussels (April 2008)
2. EN 15603: Energy performance of buildings - Overall energy use and definition of energy ratings. European Committee for Standardization (CEN), Brussels (Jan. 2008)

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ANNEX: Table with the main sets of subscripts, from CEN/TR 15615 ^{*)}

Level 1		Level 2		Level 3		Level 4	
<i>Type of energy use</i>		<i>Building without technical systems</i>		<i>Utilised or non-utilised</i>			
H	heating	nd	need	ut	utilised		
C	cooling	ht	heat transfer	nut	non-utilised		
W	DHW	tr	transmission heat transfer				
T	thermal	ve	ventilation heat transfer				
L	lighting	gn	gains				
V	ventilation	sol	solar				
A	appliances	int	internal				
XY	combination of H, C, W	sens	sensible				
Tot	total	lat	latent				
		Technical building system		Balance item		Balance item	
		us	use	ls	losses	rbl	recoverable
		sys	system	aux	auxiliary	rvd	recovered
		em	emission	in	input	nrbl	non-recoverable
		dis	distribution	out	output	nrvd	non-recovered
		st	storage				
		ctr	control				
		gen	generation				
		hum	humidification ^a				
		dhum	dehumidification ^a				
		Energy carrier		Qualifier (where used)		Qualifier (which type)	
		gas	gas	del	delivered	nren	non-renewable
		oil	oil	exp	exported	ren	renewable
		el	electricity	pr	produced		
		wd	wood	ntdel	net delivered		
		dh	district heating			aggregated quantity	
		dc	district cooling				
		sf	solid fuel			P	primary energy
		lf	liquid fuel			Ptot	total primary energy
		bm	biomass			Pnren	non renewable primary fraction
		sol	solar heat			CO2	CO ₂ emission
		pv	solar electricity				

^a Only at 'needs' level; energy use for humidification is included in energy use for ventilation; energy use for dehumidification is included in energy use for cooling

^{*)}: More detailed subscripts and detailed rules on their use can be found in CEN/TR 15615, annex D.