SLOVENSKI STANDARD
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Grelni sistemi v stavbah - Metoda za preračun energijskih zahtev in učinkovitosti sistema - 4-5. del: Sistemi za ogrevanje prostora, lastnosti in kakovost daljinskega ogrevanja in velikih sistemov

Heating systems and water based cooling systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-5: District heating and cooling

Heizungsanlagen und Wasserbasierte Kühlanlagen in Gebäuden - Verfahren zur Berechnung der Energieanforderungen und Nutzungsgrade der Anlagen - Teil 4-5: Fernwärme und Fernkälte

Systèmes de chauffage et systèmes de refroidissement à eau dans les bâtiments - Méthode de calcul des besoins énergétiques et des rendements des systèmes - Partie 4-5: Réseaux de chaleur et de froid

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ICS:

91.140.10	Sistemi centralnega ogrevanja	Central heating systems

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Heating systems and water based cooling systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-5: District heating and cooling

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 228.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Page

Foreword

This document (prEN 15316-4-5:2014) has been prepared by Technical Committee CEN/TC 228 “Heating systems and water based cooling systems in buildings”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 15316-4-5:2007.

The revision keeps the main principles of the calculation unchanged but the structure of the document was changed. Informative content was removed to the accompanying technical report prCEN/TR 15316-6-8. The provisions cover also other energy carriers than heat now. The values may be altered in a national annex.

For the calculation of cogeneration units additional methods have been introduced so specific electricity values can be calculated if required.

Calculation methods to determine energy source indicators like the renewable energy ratio have been added.

The main changes compared to EN 15316-4-5:2007 are:

a) Informative content was removed to the accompanying technical report prCEN/TR 15316-6-8;

b) provisions now also cover other energy carriers than heat;

c) Annex A contains a set of default values is provided that cover energy flows and carriers that are specific for district heating systems and are thus not covered by the building specific standards.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

Introduction

This standard is part of a package developed to support EPBD[1)] implementation, hereafter called "EPB standards".

EPB standards deal with energy performance calculation and other related aspects (like system sizing) to provide the building services considered in the EPBD.

— The subjects covered by CEN/TC 228 are the following:

— design of heating systems (water based, electrical etc.);

— installation of heating systems;

— commissioning of heating systems;

— instructions for operation, maintenance and use of heating systems;

— methods for calculation of the design heat loss and heat loads;

— methods for calculation of the energy performance of heating systems.

Heating systems also include the effect of attached systems such as hot water production systems.

All these standards are systems standards, i.e. they are based on requirements addressed to the system as a whole and not dealing with requirements to the products within the system.

Where possible, reference is made to other European or International Standards, a. o. product standards. However, use of products complying with relevant product standards is no guarantee of compliance with the system requirements.

The requirements are mainly expressed as functional requirements, i.e. requirements dealing with the function of the system and not specifying shape, material, dimensions or the like.

The guidelines describe ways to meet the requirements, but other ways to fulfil the functional requirements might be used if fulfilment can be proved.

Heating systems differ among the member countries due to climate, traditions and national regulations. In some cases requirements are given as classes so national or individual needs may be accommodated.

In cases where the standards contradict with national regulations, the latter should be followed.

This standard specifies the calculation of indicators that characterize district energy systems. The majority of district energy systems in Europe are district heating systems, but the basic principles shall also be applied on other energy carriers, e. g. district cooling. The indicators are required for the calculation of the energy performance of buildings that are connected to district energy systems.

This standard was developed during the first EPBD mandate and the first version was published in 2007.

Figure 1 shows the relative position and the modules covered by this standard within the EPB standards.

1) Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast)

Overarching			**Building (as such)**		**Technical Building Systems**										
	Descriptions			**Descriptions**		**Descriptions**	**Heating**	**Cooling**	**Ventilation**	**Humidification**	**Dehumidification**	**Domestic Hot water**	**Lighting**	**Building automation & control**	**Electricity production**
sub 1		**M1**	**sub1**	**M2**	**sub 1**		**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**
1	General		**1**	General	**1**	General	15316-1					15316-1			
2	Common terms and definitions; symbols, units and subscripts		**2**	Building Energy Needs	**2**	Needs						12831-3 ?			
3	Applications		**3**	(Free) Indoor Conditions without Systems	**3**	Maximum Load and Power	12831-1					12831-3			
4	Ways to Express Energy Performance		**4**	Ways to Express Energy Performance	**4**	Ways to Express Energy Performance	15316-1					15316-1			
5	Building Functions and Building Boundaries		**5**	Heat Transfer by Transmission	**5**	Emission & control	15316-2	15316-2							
6	Building Occupancy and Operating Conditions		**6**	Heat Transfer by Infiltration and Ventilation	**6**	Distribution & control	15316-3	15316-3				15316-3			
7	Aggregation of Energy Services and Energy Carriers		**7**	Internal Heat Gains	**7**	Storage & control	15316-5					15316-5 15316-4-3			
8	Building Partitioning		**8**	Solar Heat Gains	**8**	Generation									
					8-1	Combustion boilers	15316-4-1					15316-4-1			
					8-2	Heat pumps	15316-4-2	15316-4-2				15316-4-2			
					8-3	Thermal solar Photovoltaics	15316-4-3					15316-4-3			15316-4-3
					8-4	On-site cogeneration	15316-4-4					15316-4-4			15316-4-4
					8-5	District heating and cooling	**15316-4-5**	**15316-4-5**				**15316-4-5**			**15316-4-5**
					8-6	Direct electrical heater	15316-4-6					15316-4-6			
					8-7	Wind turbines									15316-4-7
					8-8	Radiant heating, stoves	15316-4-8								
9	Calculated Energy Performance		**9**	Building Dynamics (thermal mass)	**9**	Load dispatching and operating conditions									
10	Measured Energy Performance		**10**	Measured Energy Performance	**10**	Measured Energy Performance	15378-3					15378-3			
11	Inspection		**11**	Inspection	**11**	Inspection	15378-1					15378-1			
12	Ways to Express Indoor Comfort		**12**	--	**12**	BMS									
13	External Environment Conditions														
14	Economic Calculation	15459-1													

Figure 1 — Position of this standard in the modular structure

1 Scope

This standard defines the determination of energy indicators of district energy systems. District energy systems may be district heating, district cooling or other district energy carriers.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

prEN 15316-1, *Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 1: General and Energy performance expression*.

prEN 15316-3, *Heating systems and water based cooling systems in buildings — Method for calculation of system energy requirements and system efficiencies — Part 3: Space distribution systems (DHW, heating and cooling)*.

FprEN 15603, *Energy performance of buildings — Overarching standard EPBD*.

3 Terms and definitions

For the purpose of this document, the terms and definitions given in FprEN 15603 and the following specific definitions apply.

3.1
multi-input generation unit
energy conversion device that is fuelled by two or more energy carriers at the same time

EXAMPLE waste incinerator incl. gas-burner for ignition, coal boiler with co-firing of wood-pellets or sewage sludge, cogeneration with multiple heat generators connected by a common steam header.

3.2
single-output system
system that delivers a single energy carrier through the system boundary

3.3
multi-output system
system that delivers two or more services, products or energy carriers through the system boundary

EXAMPLE A cogeneration unit with electricity as output 1 and heat as output 2, a production process with a product as output 1 and waste heat as output 2, a production process with a product as output 1 and a residual fuel as output 2

3.4
waste heat
heat that would be waste if not used in a district heating system or heat from fuel that would be waste if not used for heat-generation

4 Symbols, subscripts and abbreviations

4.1 Symbols

For the purposes of this document, the symbols given in FprEN 15603 and the specific symbols, subscripts and abbreviations listed in Table 1 apply.

Table 1 — Symbols and units

Symbol	Name of quantity	Unit
α	allocation factor	-
σ	power to heat ratio	-
WHR	waste heat ratio	-
CHR	cogenerated heat ratio	-

4.2 Subscripts

For the purposes of this standard, the subscripts and abbreviations given in FprEN 15603 and listed in Tables 2 and 3 apply.

Table 2 — Subscripts

cm	cogeneration mode
des	district energy system
ncm	non-cogeneration mode
th	thermal
ref	reference
mig	multi-input generation device
mos	multi-output system
sos	single-output system

Table 3 — Abbreviations

Abbreviation	Term
WTE	waste to energy
MIG	multi-input generation unit

5 Indicators

5.1 Output data

The output data of this standard are listed in Table 4:

Table 4 — Output data

Description	Symbol	Unit	Intended destination module
Energy performance indicators			
primary energy factor	$f_{P;des}$	-	M1-7
emission coefficient	K_{des}	-	M1-7
Energy source indicators			
renewable energy ratio	RER_{des}	-	M1-7
waste heat ratio	WHR_{des}	-	M1-7
cogenerated heat ratio	CHR_{des}	-	M1-7

The calculation methods for energy performance indicators are described in clause 6. The calculation methods for energy source indicators are described in clause 7.

5.2 Input data and calculation time step

All indicators of a district energy system shall be determined with the same energy data, system boundaries and time step. The calculation methods are time-step independent and valid for measured and calculated energy ratings.

Existing schemes shall be calculated using the energy data from the last three years. If the system set-up or the fuel input mix has been changed within the last three years the calculation may be based on the energy data from a single year.

5.3 System boundaries

All energy indicators shall be determined within the system boundaries of the specific district energy system bordered by the energy meters at the point of delivery, e. g. the primary side of the substation in the building. Within this area, all energy inputs and all energy outputs are taken into account. Energy as input to the system is weighted by its specific conversion factor. Thus, the losses of the network are taken into account as well as all other energy used for extraction, preparation, refining, processing, transportation and conversion of the energy carrier.

NOTE The energy delivered by a district energy system may be the energy input to another district energy system.

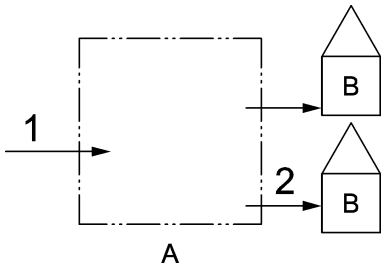
6 Calculation methods for energy performance indicators

6.1 Simplified approach

6.1.1 General

The district energy system is regarded as a black box (see Figures 2 and 3). The energy performance indicators are determined as the ratio of primary energy input to the system and energy delivered from the system. Default values can be found in FprEN 15603 Table A.10.

6.1.2 Single-output district energy systems



Key

A	system boundary	1	energy input to system	E_{in}
B	energy consumer	2	energy delivered from the system	E_{del}

Figure 2 — Single-output district energy system as a black box

$$f_P = \frac{\sum E_{in;cr} \cdot f_{P;cr}}{E_{del}} \quad (1)$$

where

f_P primary energy factor of the district energy system;

$E_{in;cr}$ energy content of input to the system of energy carrier cr;

$f_{P;cr}$ primary energy factor of energy carrier cr;

E_{del} delivered energy;

$$K = \frac{\sum E_{in;cr} \cdot K_{cr}}{E_{del}} \quad (2)$$

where

K emission coefficient of district energy system;

K_{cr} emission coefficient of energy carrier cr.

6.1.3 Multi-output district energy systems

Multi-output generation systems like cogeneration units or trigeneration of heating, cooling and electricity deliver more than one energy carrier. The energy carriers can be delivered to the same area or a different area or to another energy system. If the energy carriers are delivered to different areas or different systems the exported primary energy is counted as a bonus (see Figure 3).