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[Not translated]

Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-8: Explanation and justification of EN 15316-4-5 (District heating and cooling), Module M3-8-5, M4-8-5, M8-8-5, M11-8-5

Heizungsanlagen und Wasserbasierte Kühlanlagen in Gebäuden - Verfahren zur Berechnung der Energieanforderungen und Nutzungsgrade der Anlagen - Teil 6-8: Begleitende TR zur EN 15316-4-5 (Fernwärme und Fernkälte)

Ta slovenski standard je istoveten z: FprCEN/TR 15316-6-8

ICS:

91.120.10	Toplotna izolacija stavb	Thermal insulation of buildings
91.140.10	Sistemi centralnega ogrevanja	Central heating systems

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Performance énergétique des bâtiments - Méthode de calcul des besoins énergétiques et des rendements des systèmes - Partie 6-8 : Explication et justification de l'EN 15316-4-5 (Chauffage et refroidissement urbains), Module M3-8-5, M4-8-5, M8-8-5, M11-8-5

Heizungsanlagen und Wasserbasierte Kühlanlagen in Gebäuden - Verfahren zur Berechnung der Energieanforderungen und Nutzungsgrade der Anlagen - Teil 6-8: Begleitende TR zur EN 15316-4-5 (Fernwärme und Fernkälte)

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

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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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European foreword

This document (FprCEN/TR 15316-6-8:2016) 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 vote on TR.

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

Introduction

The set of EPB standards, technical reports and supporting tools

In order to facilitate the necessary overall consistency and coherence, in terminology, approach, input/output relations and formats, for the whole set of EPB-standards, the following documents and tools are available:

a) a document with basic principles to be followed in drafting EPB-standards: CEN/TS 16628:2014, Energy Performance of Buildings - Basic Principles for the set of EPB standards [1];

b) a document with detailed technical rules to be followed in drafting EPB-standards; CEN/TS 16629:2014, Energy Performance of Buildings - Detailed Technical Rules for the set of EPB-standards [2];

c) the detailed technical rules are the basis for the following tools:

   1) a common template for each EPB-standard, including specific drafting instructions for the relevant clauses;

   2) a common template for each technical report that accompanies an EPB standard or a cluster of EPB standards, including specific drafting instructions for the relevant clauses;

   3) a common template for the spreadsheet that accompanies each EPB standard, to demonstrate the correctness of the EPB calculation procedures.

Each EPB-standards follows the basic principles and the detailed technical rules and relates to the overarching EPB-standard, prEN ISO 52000-1 [3].

One of the main purposes of the revision of the EPB-standards is to enable that laws and regulations directly refer to the EPB-standards and make compliance with them compulsory. This requires that the set of EPB-standards consists of a systematic, clear, comprehensive and unambiguous set of energy performance procedures. The number of options provided is kept as low as possible, taking into account national and regional differences in climate, culture and building tradition, policy and legal frameworks (subsidiarity principle). For each option, an informative default option is provided (Annex B).

Rationale behind the EPB technical reports

There is a risk that the purpose and limitations of the EPB standards will be misunderstood, unless the background and context to their contents – and the thinking behind them – is explained in some detail to readers of the standards. Consequently, various types of informative contents are recorded and made available for users to properly understand, apply and nationally or regionally implement the EPB standards.

If this explanation would have been attempted in the standards themselves, the result is likely to be confusing and cumbersome, especially if the standards are implemented or referenced in national or regional building codes.

Therefore, each EPB standard is accompanied by an informative technical report, like this one, where all informative content is collected, to ensure a clear separation between normative and informative contents (see CEN/TS 16629 [2]):

— to avoid flooding and confusing the actual normative part with informative content;

— to reduce the page count of the actual standard; and

— to facilitate understanding of the set of EPB standards.

This was also one of the main recommendations from the European CENSE project [5] that laid the foundation for the preparation of the set of EPB standards.

1 Scope

This Technical Report refers to standard FprEN 15316-4-5:2016.

It contains information to support the correct understanding, use and national adaptation of FprEN 15316-4-5:2016

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.

FprEN 15316-4-5:2016, *Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-5: District heating and cooling, Module M3-8-5, M4-8-5, M8-8-5, M11-8-5*

prEN ISO 52000-1:2015, *Energy performance of buildings - Overarching EPB assessment - Part 1: General framework and procedures (ISO/DIS 52000-1:2015)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN ISO 52000-1:2015 and FprEN 15316-4-5:2016 apply.

4 Symbols, subscripts and abbreviations

For the purposes of this document, the symbols, subscripts and abbreviations given in prEN ISO 52000-1:2015 and FprEN 15316-4-5:2016 and the specific subscripts and abbreviations listed in Table 1 and Table 2 apply.

Table 1 — Specific Subscripts

Subscript	Term	Subscript	Term
abs	absorption chiller	ac	ambient cooling
carnot	carnot	cch	compression chiller
coal	coal	gf	gaseous fuel
hn	heating network	infra	infrastructure embedded
lf	liquid fuel	ncv	net calorific value
return	return	sewage	sewage sludge
supply	supply	upstr	upstream chain
wte	waste-to-energy		

Table 2 — Abbreviations

Abbreviation	Term
GCV	gross calorific value
MIG	multi-input generation unit
NCV	net calorific value
WTE	waste to energy

5 Indicators

5.1 Output data

The outcome of the calculation procedure is indicators that characterize a district energy system. The indicators are subdivided into two groups. Energy performance indicators reflect efficiency aspects as well as the source of the energy carrier. Energy source indicators don't reflect the efficiency aspects of the system but characterize the origin of the energy carrier.

In 2012/27/EU Article 2 No. (41) efficiency and energy source are defined differently: "*Efficient district heating and cooling' means a district heating or cooling system using at least 50 % renewable energy, 50 % waste heat, 75 % cogenerated heat or 50 % of a combination of such energy and heat*".

However EN 15316-4-5 does not set any efficiency requirements but provides the calculation procedures that facilitate compliance with requirements set by regulations like 2012/27/EU. *RER*, *WHR* and *CHR* can directly be used for this purpose.

5.2 Input data and calculation time step

The vast majority of systems already exist so they should be assessed on the basis of measured energy data. Due to the many factors that can affect district energy systems, the indicators can fluctuate over time. For the purpose of building regulation a fluctuating energy indicator causes unwanted effects like unequal treatment of customers connected to the same system. This can be limited by basing the calculation on a broad range of data. Thus 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.

Large systems supplying hundreds or even thousands of customers usually don't have the possibility to determine all input data on a monthly basis. Most energy indicators will therefore be valid for the whole year.

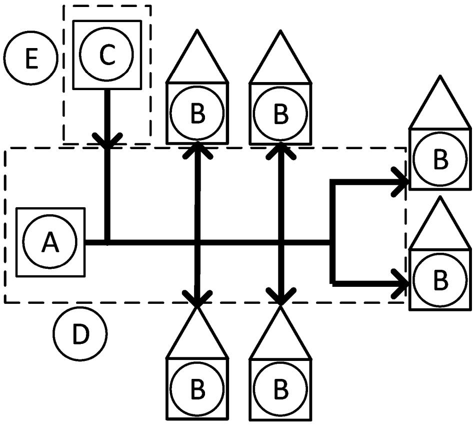
In some special cases seasonal or monthly input data are required and available, e.g. in a trigeneration system where cooling is supplied by an absorption chiller that is supplied by a cogeneration unit. On an annual data basis it would not be possible to divide the power bonus into a heating-related part and a cooling related part. Seasonal or monthly input data facilitate the determination of an accurate cooling performance indicator and a heating performance indicator. Another example is a small new system where even the delivered energy is calculated on a monthly basis.

In the determination of the final operating condition, the design conditions and manufacturing data the following developments may be taken into account: heat demand changes, changes in numbers of consumers, adaptations in generators and/or energy carriers.

5.3 System boundaries

If it is not possible or useful to calculate connected plants and networks together, they may be broken down into subsystems. This results in some subsystems which consume energy and others that supply energy. The energy from a supplier subsystem shall be assessed with its own energy indicators. For the consumer subsystem this is an external energy supply which is taken into account as an energy input with its specific energy indicators. According to FprEN 15316-4-5:2016, Table B.7 the subdivision of systems is only allowed if the energy is metered at the system boundary. This requirement ensures that the resulting indicators follow the physical energy flows. If the user of the standard wants to set deviating requirements for the subdivision of systems (e.g. contractual solutions) they shall be presented via a table following the format of FprEN 15316-4-5:2016 Table A.7.

It may be useful or necessary to divide a system when parts of the district energy network are operated by different utility companies or with different system parameters.



Key

A conversion device of consuming system

B energy consumer

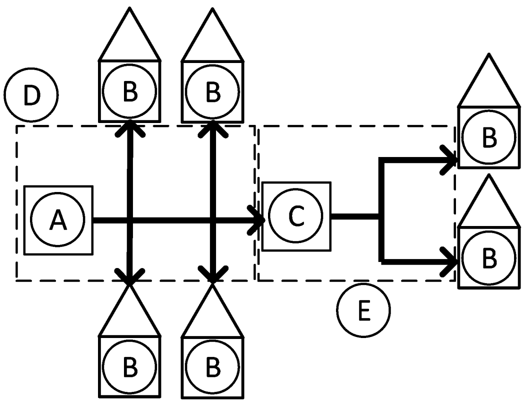
C conversion device of supplying system

D boundary of consuming system

E boundary of supplying system

Figure 1 — district energy system divided into subsystems – example 1

If the energy indicators of the supplier system cannot be calculated but at least the input energy carrier and the type of conversion device is known default values from the Annex of FprEN 15316-4-5:2016 may be used. Missing input data may be the case when the purpose of the conversion device is not primarily heating or the system operator does not measure the required energy input data.



Key

A conversion device of supplying system

B energy consumer

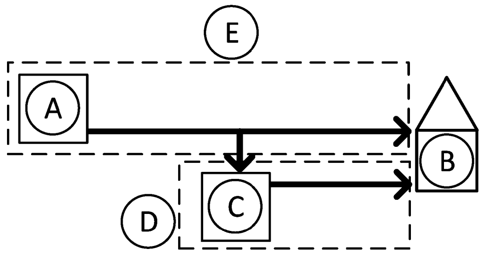
C conversion device of consuming system

D boundary of supplying system

E boundary of consuming system

Figure 2 — district energy system divided into subsystems – example 2

Example 2 is an appropriate division of a connected system if conversion device C is e.g. a biomass CHP operated by a different utility company supplying only a part of the customers. It is appropriate because the system operator who invests in more expensive fuels or technology should have the benefit from the energy performance calculation.



Key

A conversion device of heating system
B energy consumer
C conversion device of DHW system
D boundary of DHW system
E boundary of heating system

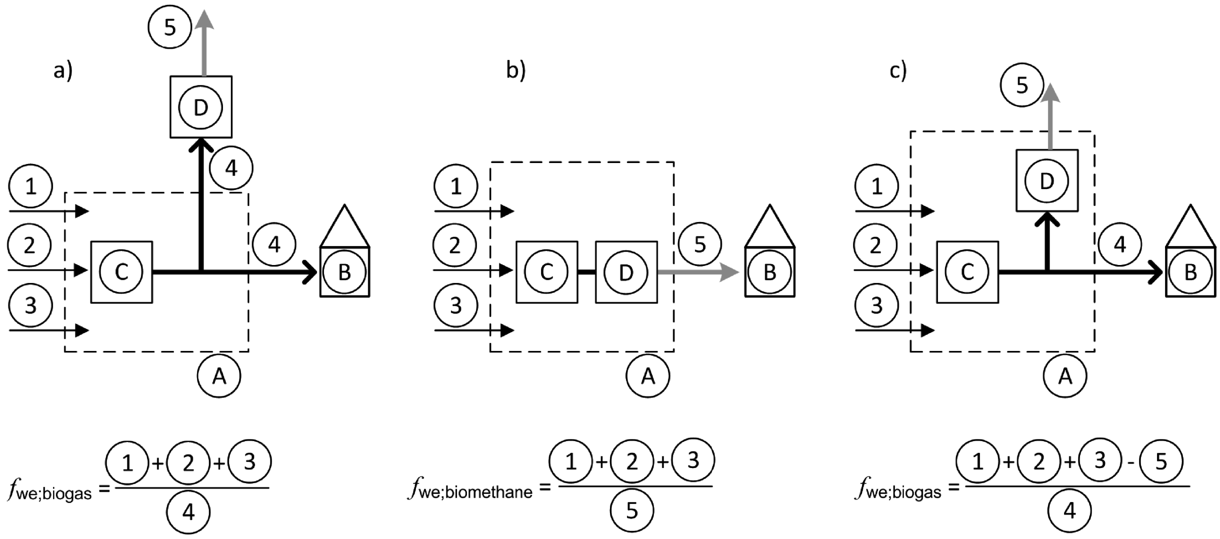
Figure 3 — district energy system divided into subsystems – example 3

Example 3 shows a 4-pipe system with two pipes for heating (system boundary E) and two pipes for domestic hot water service with a supplementary heating device, e.g. solar thermal (system boundary D).

6 Calculation methods for energy performance indicators

6.1 Simplified approach

Each district energy system is unique. So it is not possible to indicate an appropriate calculation rule for each single case, energy carrier or technology. The calculation rules have to be universal. The basic principle that is described in FprEN 15316-4-5:2016 6.1 is universal and can be applied to any scheme. As long as the system boundaries are clearly defined and all energy carriers that cross the system boundary are considered, the basic principle leads to reasonable results. (Exception: district heating system including much electricity from non-cogeneration mode, see 6.2.2.1.4) The flexibility of this approach and the different resulting options are illustrated by the following examples of a district biogas system. The biogas is generated within the system boundaries. In a second step it is upgraded by generation unit D to biomethane to match the requirements of a natural gas grid.



Key

A system boundary district biogas system
B energy consumer
C biogas generation unit
D biomethane generation unit

1 energy input biomass
2 auxiliary electricity input
3 auxiliary heat input
4 delivered biogas
5 delivered biomethane

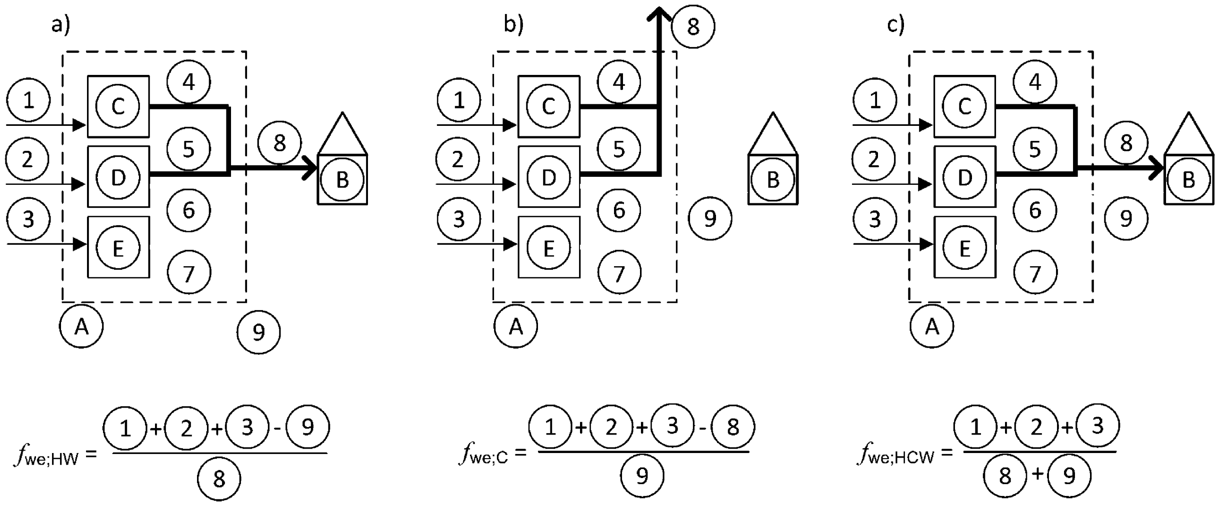
Figure 4 — basic principles illustrated by an example of a district biogas system

a) The biomethane generation unit is regarded as an energy consumer outside the assessment boundary. The amount of biogas that is exported to the biomethane generation unit is regarded as delivered biogas and thus added to the denominator. The weighting factors of the biomethane have to be calculated separately.

b) The biomethane generation unit is inside the assessment boundary. Biomethane is the delivered energy carrier and therefore in the denominator.

c) The biomethane generation unit is inside the assessment boundary. Biogas is regarded as the delivered energy carrier. Biomethane is exported from the system so it becomes a multi-output system. The allocation of weighted energy flows to the outputs can either be based on conventions or on mathematical allocation methods that use the energy flows as input data. The easiest convention is to set a default value for the weighting factors of the exported biomethane. This could be e.g. the marginal weighting factor of the national gas grid.

The second example is a system that delivers heating and cooling. A heat generator produces heat, a chiller produces cooling and a heat pump produces heating and cooling. For the simplified approach only energy flows that cross the system boundary are required (quantities 1, 2, 3, 8 and 9). The simplified approach can be applied in three different ways:



Key

A	system boundary	1	energy input to heat generator
B	energy consumer	2	electricity input heat pump
C	heat generator	3	electricity input chiller
D	heat pump	4	heat output heat generator
E	chiller	5	heat output heat pump
		6	cooling output heat pump
		7	cooling output chiller
		8	heat delivered by the system
		9	cooling delivered by the system

Figure 5 — basic principles illustrated by an example of a district heating and cooling system

a) district heating is regarded as the main product of the system and its weighting factor is required for the assessment of the connected buildings. Cooling is exported to another system or area and is counted as a bonus. The weighting factors of the exported cooling can either be default values based on conventions or be calculated based on the avoided weighted energy in the external system.

b) district cooling is regarded as the main product of the system and its weighting factor is required for the assessment of the connected buildings. Heat is exported to another system or area and is counted as a bonus. The weighting factors of the exported heat can either be default values based on conventions or be calculated based on the avoided weighted energy in the external system.

c) heating and cooling are delivered to the same customers and are assessed together with the same weighting factors. This case is an example for the combination of systems according to FprEN 15316-4-5:2016 6.2.3 and Table B.6. If both a specific weighting factor for heating and a specific weighting factor for cooling are required, the detailed calculation rule according to FprEN 15316-4-5:2016 6.2.2.4 has to be applied. For this calculation quantities 5 and 6 are required: