

This is a preview of "ISO/TR 52000-2:2017". [Click here to purchase the full version from the ANSI store.](#)

First edition  
2017-06

---

---

## **Energy performance of buildings — Overarching EPB assessment —**

### **Part 2: Explanation and justification of ISO 52000-1**

*Performance énergétique des bâtiments — Évaluation globale  
de la PEB —*

*Partie 2: Explication et justification de l'ISO 52000-1*



Reference number  
ISO/TR 52000-2:2017(E)

© ISO 2017



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Ch. de Blandonnet 8 • CP 401  
CH-1214 Vernier, Geneva, Switzerland  
Tel. +41 22 749 01 11  
Fax +41 22 749 09 47  
copyright@iso.org  
www.iso.org

This is a preview of "ISO/TR 52000-2:2017". [Click here to purchase the full version from the ANSI store.](#)

## Contents

	Page
<b>Foreword</b> .....	<b>vi</b>
<b>Introduction</b> .....	<b>vii</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>2</b>
3.1 Buildings.....	2
3.2 Indoor and outdoor conditions.....	3
3.3 Technical building systems.....	3
3.4 Energy.....	4
3.5 Energy performance.....	4
3.6 Energy calculation.....	4
3.7 General information on terms and definitions.....	4
3.7.1 General.....	4
3.7.2 Overarching terms and definitions.....	4
3.7.3 Difference between definition and specification.....	5
3.7.4 Undefined and/or unspecified policy related terms.....	5
<b>4 Symbols, units, subscripts and abbreviations</b> .....	<b>5</b>
4.1 Symbols.....	5
4.2 Subscripts.....	6
4.3 Abbreviations.....	6
<b>5 Description of the overarching framework and procedures</b> .....	<b>6</b>
5.1 Output of the method.....	6
5.2 General description of the procedures and routing.....	7
5.3 Selection criteria between the methods.....	7
5.4 The over-arching reference modular structure.....	7
5.4.1 Purpose.....	7
5.4.2 Systematic modular structure of the standards.....	7
5.4.3 The connection between the modules – step by step implementation.....	8
5.4.4 Systematic consecutive numbering of the standards.....	10
<b>6 Overarching preparation steps</b> .....	<b>11</b>
6.1 General.....	11
6.2 List of types and categories.....	13
6.2.1 Type of object.....	13
6.2.2 Building category and space categories.....	14
6.2.3 Type of application.....	15
6.2.4 Types of assessment.....	15
6.2.5 Building services.....	16
6.3 Identification of types and categories for a specific case.....	17
6.4 Example cases.....	17
6.4.1 General.....	17
6.4.2 Example case 1.....	18
6.4.3 Example case 2.....	19
6.4.4 Example case 3.....	19
6.4.5 Example case 4.....	20
6.4.6 Example case 5.....	21
6.4.7 Example case 6.....	22
<b>7 Calculated energy performance of buildings</b> .....	<b>22</b>
7.1 Output data.....	22
7.2 Calculation intervals and calculation period.....	22
7.2.1 Calculation interval.....	22
7.2.2 Calculation period.....	25
7.3 Input data.....	25

7.3.1	Product data.....	25
7.3.2	System design data.....	25
7.3.3	Operating conditions.....	25
7.3.4	Constants and physical data.....	27
7.3.5	Other data.....	27
7.4	Description of the calculation procedure.....	28
<b>8</b>	<b>Measured overall energy performance and comparison with calculations.....</b>	<b>28</b>
8.1	General.....	28
8.2	Output of the method.....	29
8.3	Measurement intervals and measurement period.....	29
8.4	Input data.....	30
8.4.1	Product data.....	30
8.4.2	System design data.....	30
8.4.3	Operating conditions data.....	30
8.4.4	Constants and physical data.....	31
8.4.5	Other data.....	31
8.5	Measurement procedures.....	31
8.6	Calculation of the energy performance based on measured energy.....	31
8.7	Comparison between calculated energy performance and measured energy performance.....	31
8.8	Measured energy performance reporting.....	32
<b>9</b>	<b>Overall assessment of the energy performance of buildings.....</b>	<b>32</b>
9.1	Categorization of building and/or spaces.....	32
9.2	Combination of building services included in EPB in each space.....	32
9.3	Useful floor area and air volume.....	32
9.4	Normalization to building size.....	33
9.4.1	Reference size.....	33
9.4.2	Normalization.....	35
9.4.3	Reference floor area.....	35
9.5	Assessment boundary and perimeters.....	35
9.5.1	General principles.....	35
9.5.2	Assessment boundary for multiple buildings.....	36
9.6	Overall energy performance.....	36
9.6.1	Weighted overall energy balance.....	36
9.6.2	Primary energy factors.....	37
9.6.3	Greenhouse gas emission factors.....	39
9.6.4	Additional weighting factors.....	39
9.6.5	Costs factors.....	39
9.6.6	Weighting factors for exported energy.....	39
9.6.7	Energy flows.....	42
9.7	Share of renewable energy.....	43
9.7.1	General.....	43
9.7.2	Amount of primary energy from renewable source $E_{P,ren}$ .....	43
9.7.3	Amount of total primary energy $E_{P,tot}$ .....	43
9.7.4	Examples of RER calculation.....	43
9.8	Energy performance indicators for technical building systems.....	45
9.9	Calculation methods for energy performance indicators per part of a building and/or service.....	45
<b>10</b>	<b>Zoning.....</b>	<b>46</b>
10.1	General.....	46
10.2	Thermal zones and service areas.....	48
10.3	Spaces.....	48
10.4	Zoning rules.....	50
10.4.1	Principle.....	50
10.4.2	Specific zoning criteria.....	51
10.5	Assignment rules.....	52
10.5.1	Subdivision.....	52

This is a preview of "ISO/TR 52000-2:2017". [Click here to purchase the full version from the ANSI store.](#)

10.5.2	Recombination.....	54
10.6	Zoning procedure.....	55
<b>11</b>	<b>Calculation of the energy performance, routing and energy balance.....</b>	<b>55</b>
11.1	General.....	55
11.2	Overall calculation procedure (steps).....	55
11.3	Calculation principles of the recovered gains and losses.....	56
11.4	Effect of building automation and control (BAC) and technical building management (TBM).....	56
11.5	Climatic and external environment data.....	61
11.6	Overall energy performance.....	61
11.6.1	General.....	61
11.6.2	Electricity and other energy carriers with exportation.....	61
11.6.3	Energy carriers without exportation.....	72
11.6.4	Exported heat on-site produced and not included in thermal use of the building.....	72
<b>12</b>	<b>Common overarching output – General.....</b>	<b>73</b>
12.1	General.....	73
12.2	Tabulated overview of the amounts of energy per energy carrier and energy service.....	75
12.2.1	Absolute values.....	75
<b>13</b>	<b>Additional information to the over-arching EPB standard.....</b>	<b>89</b>
13.1	Worked out examples.....	89
13.2	Application range.....	89
13.3	Regulation use.....	89
13.4	Validation test.....	90
13.5	Quality issues.....	90
<b>Annex A</b>	<b>(informative) Input and method selection data sheet — Template.....</b>	<b>91</b>
<b>Annex B</b>	<b>(informative) Input and method selection data sheet — Default choices.....</b>	<b>93</b>
<b>Annex C</b>	<b>(informative) Common subscripts.....</b>	<b>101</b>
<b>Annex D</b>	<b>(informative) Calculation of measured energy performance.....</b>	<b>108</b>
<b>Annex E</b>	<b>(informative) Calculation methods for energy performance indicators per part of a building and/or service.....</b>	<b>109</b>
<b>Annex F</b>	<b>(informative) Alphabetic index of terms.....</b>	<b>116</b>
<b>Annex G</b>	<b>(informative) Electrical grid related indicators.....</b>	<b>117</b>
<b>Annex H</b>	<b>(informative) Proposal of indicators for the assessment of nearly Zero-Energy Buildings (NZEB).....</b>	<b>118</b>
<b>Annex I</b>	<b>(informative) Lighting systems.....</b>	<b>121</b>
<b>Annex J</b>	<b>(informative) Calculation examples.....</b>	<b>123</b>
<b>Annex K</b>	<b>(informative) Flow diagram.....</b>	<b>170</b>
<b>Annex L</b>	<b>(informative) List of technologies.....</b>	<b>174</b>
<b>Bibliography</b>	<b>.....</b>	<b>178</b>

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

ISO/TR 52000-2 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 371, *Energy Performance of Buildings project group*, in collaboration with ISO Technical Committees TC 163, *Thermal performance and energy use in the built environment*, and TC 205, *Building environment design*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 52000 series can be found on the ISO website.

This is a preview of "ISO/TR 52000-2:2017". Click here to purchase the full version from the ANSI store.

## 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<sup>[13]</sup>;
- 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<sup>[14]</sup>;

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, ISO 52000-1<sup>[1]</sup>.

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<sup>[14]</sup>):

- 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<sup>[5]</sup> that laid the foundation for the preparation of the set of EPB standards.

This is a preview of "ISO/TR 52000-2:2017". Click here to purchase the full version from the ANSI store.

**This document**

This document accompanies the overarching EPB standard (ISO 52000-1) that addresses the overarching principles for EPB-standards. The overarching EPB standard, contains the common terms, definitions and overall energy performance assessment procedures, as a basis for a systematic, clear and comprehensive set of EPB standards. It forms part of a set of standards related to the evaluation of the energy performance of buildings (EPB).

The role and the positioning of ISO 52000-1 in the set of EPB standards is defined in the Introduction to the standard.

**Accompanying spreadsheets**

Spreadsheets are produced through the implementation of ISO 52000-1. These spreadsheets (including possible updated versions) are available at [www.epb.center](http://www.epb.center). In this document, examples of each of these calculation sheets are included.

**Background and history of this document, ISO 52000-1 and the set of EPB standards<sup>1)</sup>:**

***Boosting energy efficiency of buildings***

Since buildings burn 40 % of all the energy consumed, designing better buildings and retrofitting existing ones will help to reduce the energy demand and to create significant job opportunities world-wide.

The building sector has a great potential to reduce the greenhouse gas emissions, in line with the climate targets set at the Paris climate conference (COP21) in December 2015. Helping to decarbonize the building sector is the goal of the new holistic approach, the set of EPB standards (ISO 52000-series; see below under “Road ahead”) being developed for the energy performance of buildings (EPB).

***Holistic approach***

<b>The set of EPB standards ...</b>	
<b>take into account</b>	<b>and include:</b>
• indoor climate	• needs
• thermal properties (of walls, windows, etc.)	• use
• heating	• calculation
• cooling and air conditioning	• measurement
• domestic hot water	• inspection
• ventilation	• building design
• lighting	• new and existing buildings
• (de)humidification	• certification/labelling
• building automation and control (BAC/BMS)	• simple and complex buildings
• renewable energy sources	

***Why is the holistic approach important for the energy performance of buildings (EPB) ?***

In the past, energy performance requirements were set at component level – minimum thermal insulation levels and minimum efficiencies of products. This, however, leads to sub-optimal solutions and creates a barrier to the necessary technology transitions.

The holistic approach to assessing the overall energy performance of buildings and the built environment, provided by the set of EPB standards, is a key tool to overcome these barriers.

1) The references [26] to [43] (see bibliography) contain more extensive background information on the set of EPB standards.



This is a preview of "ISO/TR 52000-2:2017". [Click here to purchase the full version from the ANSI store.](#)

The set of EPB standards enable to assess the overall energy performance of a building. This means that any combination of technologies can be used to reach the intended energy performance level, at the lowest cost.

Due to this 'competition' between different technologies, the holistic approach is a key driver for technological innovation and change. Countries using the approach for several years – take, for instance, the Netherlands – have experienced large scale implementation and cost savings on a variety of new technologies.

And there is the economic benefit: Energy expenditures account for a substantial part of a building's total operating costs.

***Who are the potential users of the EPB set of standards, and what should they be aware of?***

The energy assessment of buildings is carried out for various purposes, such as:

- judging compliance with building regulations expressed in terms of limited energy use or a related quantity,
- increasing transparency in real-estate transactions through an energy performance certification and/or display of the level of energy,
- monitoring the energy efficiency of the building and its technical building systems,
- helping to plan retrofit measures through predicting energy savings that would result from various actions.

In general, the holistic approach means that the energy performance is assessed as the total energy used for heating, cooling, lighting, ventilation, domestic hot water, and, in some cases, appliances. It ensures that all technologies are treated equally and balanced.

With the EPB set of standards:

- **Policy makers** acquire an instrumentation that enables them to take measures in the built environment and to quantify how much these measures would reduce the energy consumed in buildings.
- **Building industry, engineers and designers** can improve the energy-efficiency of their designs, building products and systems. The set of standards take these current and future products, systems and designs into account. Due to the holistic approach the risk of suboptimum solutions at component level is minimized. This way industry knows in what direction to innovate.
- **Building owners and occupants** can benchmark against other buildings and predict the energy saving potential of improvements.

***First editions: European standards***

The set of standards and accompanying technical reports on the energy performance of buildings have been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association (Mandate M/480<sup>[4]</sup>)

Directive 2010/31/EU recasting the Directive 2002/91/EC on energy performance of buildings (EPBD<sup>[2]</sup>) promotes the improvement of the energy performance of buildings within the European Union, taking into account all types of energy uses (heating, lighting, cooling, air conditioning, ventilation) and outdoor climatic and local conditions, as well as indoor climate requirements and cost effectiveness (Article 1).

The first mandate to CEN to develop a set of CEN EPBD standards (M/343<sup>[3]</sup>), to support the first edition of the EPBD<sup>[2]</sup> resulted in the successful publication of all EPBD related CEN standards in 2007-2008.

The mandate M/480 was issued to review the previous mandate M/343 as the recast of the EPBD raised the need to revisit the standards and reformulate and add standards so that they become on the one

This is a preview of "ISO/TR 52000-2:2017". [Click here to purchase the full version from the ANSI store.](#)

hand unambiguous and compatible, and on the other hand a clear and explicit overview of the choices, boundary conditions and input data that need to be defined at national or regional level. Such national or regional choices remain necessary, due to differences in climate, culture & building tradition, policy and legal frameworks. Consequently, the set of CEN-EPBD standards published in 2007-2008 had to be improved and expanded on the basis of the recast of the EPBD.

### ***Road ahead: ISO 52000- series***

The numbers ISO 52000 through ISO 52150 are reserved for the EPB standards. So in the near future the term ISO 52000 series of standards will become equivalent to the term EPB set of standards.

Only standards that meet specific requirements, will be awarded such number. Currently, only 15 numbers are issued, mostly general EPB standards, or for building (thermal, solar) calculations. In 2017/2018 some 30 standards might become an ISO 52xxx standard, making use of the work already done in Europe.

The ISO 52000 series is modular and flexible, making it the perfect basis for future developments like innovations, new insights and new market demands.