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Light and lighting — Energy performance of lighting in buildings

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

CIE Central Bureau
Babenbergerstraße 9/9A
A-1010 Vienna, Austria
Phone: +43 1 714 3187
Fax: +41 22 749 09 47
Email: ciecb@cie.co.at
Website: www.cie.co.at

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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).

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).

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

For an explanation of 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 www.iso.org/iso/foreword.html.

ISO collaborates closely with the International Commission on Illumination (CIE) on all matters of standardization for light and lighting.

This document was prepared by Technical Committee ISO/TC 274, *Light and lighting*. The document has been jointly prepared with CIE JTC 6, *Energy performance of lighting in buildings*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

It is of paramount importance that correct lighting is provided in buildings. The convention and procedures in this document assumes that the designed and installed lighting scheme conforms to good lighting practices. For new and refurbished installations in the non-residential building sector the design of the lighting system should conform to the requirements in the lighting applications standards ISO 8995-1/CIE S 008 for indoor workplaces and ISO 30061/CIE S 020 for emergency escape lighting. This document also assumes that the buildings can have access to daylight to provide all or some of the illumination required in the rooms or zones and that in addition there will be an adequate amount of electric lighting installed to provide the required illumination in the absence of daylight.

This document defines the methods for estimating or measuring the amount of energy required or used for lighting in buildings. The method of separate metering of the energy used for lighting will also give regular feedback on the effectiveness of the lighting control.

The methodology of energy estimation not only provides values for the Lighting Energy Numeric Indicator (LENI) but it will also provide input for the heating and cooling load estimations for the combined total energy performance of building indicator.

Figure 1 gives an overview of the methodology and the flow of the processes involved.

NOTE The dotted line linking preliminary annual LENI to the comprehensive method indicates the required follow-up of the budget calculation with the comprehensive calculation during the detailed lighting design process.

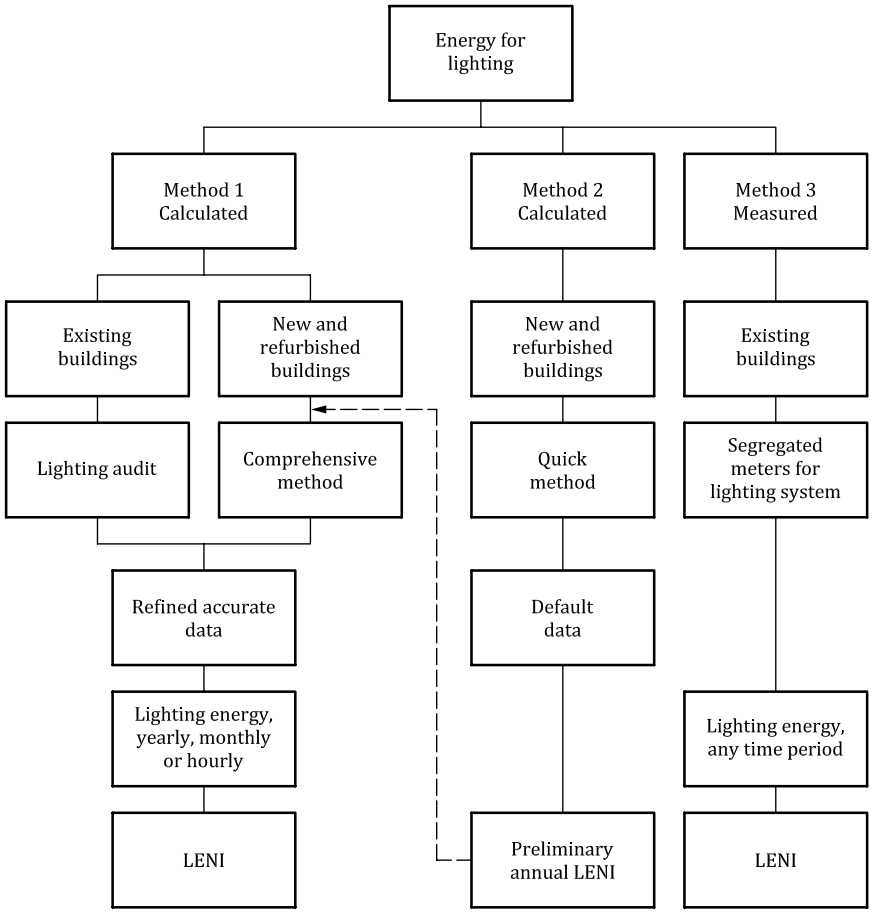


Figure 1 — Flow chart illustrating alternative routes to determine energy use

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Light and lighting — Energy performance of lighting in buildings

1 Scope

This document specifies the methodology for evaluating the energy performance of lighting systems for providing general illumination inside non-residential buildings and for calculating or measuring the amount of energy required or used for lighting inside buildings.

This document does not cover lighting requirements, the design of lighting systems, the planning of lighting installations, the characteristics of lighting equipment (lamps, control gear and luminaires) and systems used for display lighting, desk lighting or luminaires built into furniture. This document does not provide any procedure for the dynamic simulation of lighting scene setting.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8995-1/CIE S 008, *Lighting of work places — Part 1: Indoor*

ISO 10916, *Calculation of the impact of daylight utilization on the net and final energy demand for lighting*

ISO 30061/CIE S 020, *Emergency lighting*

IEC 60598 (all parts), *Luminaires*

CIE S 017, ILV, *International Lighting Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in CIE S 017 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
time step
t_s
period in which the energy is evaluated

Note 1 to entry: Measured in hour, month, year.

3.2
standby energy
energy required for charging batteries and/or the energy required for lighting controls during the time the electric lights are switched off

Note 1 to entry: Lighting controls and emergency battery charging circuits are only considered where power is supplied via a luminaire.

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3.3
lighting control
device connected to the luminaire to vary the light output

Note 1 to entry: In this document lighting controls are only considered where power is supplied via a luminaire.

3.4
lighting system
set of light sources and/or lamps with luminaires and related equipment, if any, interacting together to satisfy lighting application requirements

Note 1 to entry: The lighting system can be dedicated to:

a) the support of (a) specified visual task(s) under specified conditions considering other requirements such as human comfort, safety, the appearance of the surrounding environment and energy consumption;

b) the support of other than human tasks, such as plant growth or breeding of animals.

Note 2 to entry: The lighting system can include physical components, communication protocols, user interfaces, software and networks to provide control and monitoring functions.

[SOURCE: CIE DIS 017:2016; Term 17-29-029]

3.5
expenditure factor
expense factor
effort factor
indicator of the energy efficiency of a given lighting system compared to a reference system

4 Symbols and abbreviations

4.1 Symbols

For the purposes of this document, the specific symbols listed in Table 1 apply.

Table 1 — Symbols and units

Symbol	Name of quantity	Unit
A	Total useful area	m^2
A_D	Partial area which is lit by daylight	m^2
A_{ND}	Area not lit by daylight	m^2
A_s	Sum of task areas within the room	m^2
D	Daylight factor	%
D_{class}	Daylight availability classification	1
e_L	Expenditure factor for lighting systems	1
$e_{L,C}$	Partial expenditure factor for constant illuminance control	1
$e_{L,D}$	Partial expenditure factor for daylight dependant lighting control	1
$e_{L,ES}$	Partial expenditure factor for the electric lighting system	1
$e_{L,ES,del}$	Partial expenditure factor for delivery of electric light	1
$e_{L,ES,dis}$	Partial expenditure factor for distribution of electric light	1
$e_{L,ES,gen}$	Partial expenditure factor for generation of electric light	1
$e_{L,O}$	Partial expenditure factor for occupancy dependant lighting control	1
E_m	Maintained illuminance	lx
E_{sur}	Maintained illuminance on immediate surround of task area	lx
E_{task}	Maintained illuminance on the task area	lx

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