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Information technology — Data centres — Impact of the ISO 52000 series on energy performance of buildings

Technologies de l'information — Centres de données — Impact de la série ISO 52000 sur la performance énergétique des bâtiments

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

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Foreword

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Introduction

It is recognized that no “free” energy exists, even if certain processes or technical solutions are implemented in data centres, whose names can potentially suggest that energy is free (e.g. renewable energy, "free" cooling with air or water, geo-cooling, etc.).

In particular:

— even if the cost of certain renewable energy sources is low compared to non-renewable sources, there are still costs associated with the use or implementation of renewable energies such as transport and/or storage;

— some energy-efficient solutions implemented in data centres can also have other capital and operational energy costs;

— the remaining energy going out of a subsystem of a data centre, if not evaluated inside or outside the data centre boundary, is lost; every effort in order to minimize these losses results in improved energy efficiency of the data centre.

Regulatory frameworks exist (for example, in the European Union) which request primary energy assessment and that the energy consumption of computer rooms included in commercial or residential buildings can be assessed within primary energy as part of the overall energy consumption for these types of buildings.

The common objective of the key performance indicators (KPI) specified in the ISO/IEC 30134 series is the efficient or effective use or utilization of energy and other resources.

The ISO 52000 series defines methods and tools to assess the energy performance of buildings (EPB), routing and energy balance, together with greenhouse gas emissions.

These methods and tools are to be used (when mandatory) for mixed use buildings that include a data centre or server room in their premises. They can also be used in the case of stand-alone data centres.

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Information technology — Data centres — Impact of the ISO 52000 series on energy performance of buildings

1 Scope

This document proposes elements for the expression of energy production, storage, reuse and consumption in reference to primary energy in data centres, taking into account both the elements needed for energy assessment and the concepts developed in the framework of the ISO 52000 series for energy performance of buildings (EPB).

This document:

— provides the main definitions and concepts from the ISO 52000 series needed to make a primary energy assessment for data centres;

— provides approaches for discriminating true sources of energy used by a given data centre;

— compares, where relevant, the terms used in both the ISO/IEC 30134 series and ISO 52000 series and provides explanations on the use of factors for converting final or delivered energy to primary energy which take a different approach in each series (and how to move from one to the other);

— illustrates the impact of using the EPB approach on data-centre-energy-related key performance indicators (KPIs), both in general and by the provision of examples;

— provides known sources of weighting or conversion factors to be used when there are no recognized or agreed local factors applicable to the studied data centre energy performance assessment.

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/IEC 30134 (all parts), *Information technology — Data centres key performance indicators*

ISO/IEC 22237 (all parts), *Information technology — Data centre facilities and infrastructures*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in the ISO/IEC 30134 series and the ISO/IEC 22237 series and the following apply.

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

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

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

3.1.1
assessment boundary
boundary where the delivered and exported energy are measured or calculated

[SOURCE: ISO 52000-1:2017, 3.4.2]

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3.1.2
bin
statistical temperature class (sometimes a class interval) for the outdoor air temperature, with the class limits expressed in a temperature unitNote 1 to entry: The bin usually includes non-consecutive interval of times with the same temperature condition.

[SOURCE: ISO 52000-1:2017, 3.6.2]

3.1.3
delivered energy
energy, expressed per energy carrier, supplied to the data centre through the assessment boundary, to satisfy the uses taken into account or to produce the exported energy

Note 1 to entry: Delivered energy can be calculated for defined energy uses or it can be measured.

[SOURCE: ISO 52000-1:2017, 3.4.6, modified — Reference to "technical building systems" replaced by "data centre".]

3.1.4
distant
<to the data centre premises>not on-site nor nearby

[SOURCE: ISO 52000-1:2017, 3.4.7, modified — Domain changed from "<to the building site>" to "<to the data centre premises>".]

3.1.5
electricity grid
public electricity network

[SOURCE: ISO 52000-1:2017, 3.4.8]

3.1.6
energy carrier
substance or phenomenon that can be used to produce mechanical work or heat or to operate chemical or physical processes

[SOURCE: ISO 52000-1:2017, 3.4.9]

3.1.7
energy source
source from which useful energy can be extracted or recovered either directly or by means of a conversion or transformation process

EXAMPLE Oil or gas fields, coal mines, sun, wind, the ground (geothermal energy), the ocean (wave energy, ocean thermal energy), forests etc.

[SOURCE: ISO 52000-1:2017, 3.4.15]

3.1.8
exported energy
energy, expressed per energy carrier, supplied by the technical data centre systems through the assessment boundary

Note 1 to entry: It can be specified by generation types [e.g. combined heat and power (CHP) and photovoltaic (PV)] in order to apply different conversion factors.

Note 2 to entry: Exported energy can be calculated or it can be measured.

[SOURCE: ISO 52000-1:2017, 3.4.20, modified — Reference to "building systems" replaced by "data centre systems"; in Note 1 to entry, reference to "weighting factors" replaced by "conversion factors".]

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3.1.9
final energy
energy as delivered to an energy-using system

Note 1 to entry: This concept is sometimes referred to as "delivered energy".

[SOURCE: ISO/IEC 13273-1:2015, 3.1.11, modified — Note 2 to entry deleted.]

3.1.10
nearby
<energy source> usable only at local or district level, connected to the same branch of the distribution network (for electricity: distribution network meaning medium voltage or lower) or having a dedicated connection, requiring specific equipment for the assessed data centre to be connected to it (e.g. district heating or cooling)

Note 1 to entry: This definition is based on that given for the same term in ISO 52000-1:2017, 3.4.24.

Note 2 to entry: The concept of "nearby" is expressed here in relation to the data centre premises. See Annex A and Annex B for further explanation.

3.1.11
non-renewable energy
energy taken from a source which is depleted by extraction (e.g. fossil fuels)

Note 1 to entry: Resource that exists in a finite amount that cannot be replenished on a human time scale.

[SOURCE: ISO 52000-1:2017, 3.4.26]

3.1.12
on-site
building, premises and the parcel of land on which the data centre is located

Note 1 to entry: On-site is defining a strong link between the energy source (localization and interaction) and the data centre

[SOURCE: ISO 52000-1:2017, 3.4.27, modified — References to "the building" replaced by "the data centre" in both the definition and Note 1 to entry; "Building" added to the beginning of the definition.]

3.1.13
perimeter
<boundary classification>origin of delivered energy

Note 1 to entry: This document distinguishes between "on-site", "nearby" and "distant" energy sources.

[SOURCE: ISO 52000-1:2017, 3.4.28]

3.1.14
primary energy
energy that has not been subjected to any conversion or transformation process

Note 1 to entry: Primary energy includes non-renewable energy and renewable energy. If both are taken into account it can be called total primary energy.

[SOURCE: ISO 52000-1:2017, 3.4.29]

3.1.15
technical data centre system
technical equipment for heating, cooling, ventilation, humidification, dehumidification, domestic hot water, lighting, building automation and control and electricity production (other than for IT services)

Note 1 to entry: A technical data centre system can refer to one or to several data centre services.

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Note 2 to entry: A technical data centre system is composed of different sub-systems. A technical data centre sub-system is a part of a technical data centre that performs a special function (e.g. air handling, cold generation and distribution, water-based cooling, etc.).

Note 3 to entry: Electricity production can include electrical power supply generation equipment (including fuel storage), cogeneration, wind power and photovoltaic systems, transformers.

3.1.16
uninterruptible power system
UPS
combination of convertors, switches and energy storage devices (such as batteries), constituting a power system for maintaining continuity of load power in case of input power failure

Note 1 to entry: Continuity of load power occurs when voltage and frequency are within rated steady-state and transient tolerance bands, and with distortion and interruptions within the limits specified for the output port. Input power failure occurs when voltage and frequency are outside rated steady-state and transient tolerance bands, or with distortion or interruptions outside the limits specified for the UPS.

[SOURCE: IEC 62040-1:2017, 3.1.01]

3.2 Abbreviated terms

For the purposes of this document, the abbreviated terms given in the ISO/IEC 30134 series, the ISO/IEC 22237 series and the following apply.

CHP	combined heat and power
COP	coefficient of performance
EPB	energy performance of buildings
ERF	energy reuse factor
ITEEsv	IT equipment energy efficiency for servers
PV	photovoltaic
CHP	cogeneration, combined heat and power
PDU	power distribution unit
PUE	power usage effectiveness
REF	renewable energy factor
RER	renewable energy ratio
SLA	service level agreement
UPS	uninterruptible power system
XEEF	excess electrical energy factor

3.3 Symbols (variables)

For the purposes of this document, the following symbols apply. These symbols are used throughout the document in combination with the indices defined in 3.4.

E	energy consumption or loss

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