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Information technology - Data centre facilities and infrastructures - Part 99-1: Recommended practices for energy management

Informationstechnik - Einrichtungen und Infrastrukturen von Rechenzentren - Teil 99-1: Empfohlene Praktiken für das Energiemanagement

Technologies de l'information - Installations et infrastructures de centres de traitement de données - Partie 99-1 : Pratiques recommandées relatives à la gestion énergétique

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European Committee for Electrotechnical Standardization
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Contents Page

European foreword

This document (CLC/TR 50600-99-1:2019) has been prepared by CLC/TC 215 “Electrotechnical aspects of telecommunication equipment” in conjunction with the Directorate-General Joint Research Centre (DG JRC) of the European Commission (EC).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes CLC/TR 50600-99-1:2018.

CLC/TR 50600-99-1:2019 includes the following significant technical changes with respect to CLC/TR 50600-99-1:2018:

— by updating to recently agreed energy management practices and aligns with the 2019 edition of the *EU Code of Conduct for data centres Best Practices* document.

— Environmental Sustainability practices incorporated within the 2019 edition of the *EU Code of Conduct for data centres Best Practices* document have now been re-located to CLC/TR 50600-99-2:2019.

This document aligns with the Best Practices document of the Code of Conduct for Data Centre Energy Efficiency (CoC) scheme operated by the DG JRC and continues to be prepared by data centre experts from operators, vendors, consultants, academics, professional and national bodies.

The publication of this Technical Report is intended to integrate recommended Practices of energy management into the EN 50600 series developed by CLC/TC 215.

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

Regarding the structure of the EN 50600 series, see the Introduction.

Introduction

The unrestricted access to internet-based information demanded by the information society has led to an exponential growth of both internet traffic and the volume of stored/retrieved data. Data centres are housing and supporting the information technology and network telecommunications equipment for data processing, data storage and data transport. They are required both by network operators (delivering those services to customer premises) and by enterprises within those customer premises.

Data centres need to provide modular, scalable and flexible facilities and infrastructures to easily accommodate the rapidly changing requirements of the market. In addition, energy consumption of data centres has become critical both from an environmental point of view (reduction of carbon footprint) and with respect to economic considerations (cost of energy) for the data centre operator.

The implementation of data centres varies in terms of:

a) purpose (enterprise, co-location, co-hosting, or network operator facilities);

b) security level;

c) physical size;

d) accommodation (mobile, temporary and permanent constructions).

The needs of data centres also vary in terms of availability of service, the provision of security and the objectives for energy efficiency. These needs and objectives influence the design of data centres in terms of building construction, power distribution, environmental control and physical security. Effective management and operational information is required to monitor achievement of the defined needs and objectives.

This series specifies requirements and recommendations to support the various parties involved in the design, planning, procurement, integration, installation, operation and maintenance of facilities and infrastructures within data centres. These parties include:

1) owners, facility managers, ICT managers, project managers, main contractors;

2) architects, consultants, building designers and builders, system and installation designers;

3) facility and infrastructure integrators, suppliers of equipment;

4) installers, maintainers.

At the time of publication of this Technical Report, EN 50600 series will comprise the following standards and documents:

EN 50600-1, *Information technology — Data centre facilities and infrastructures — Part 1: General concepts*;

EN 50600-2-1, *Information technology — Data centre facilities and infrastructures — Part 2-1: Building construction*;

EN 50600-2-2, *Information technology — Data centre facilities and infrastructures — Part 2-2: Power supply and distribution*;

EN 50600-2-3, *Information technology — Data centre facilities and infrastructures — Part 2-3: Environmental control*;

EN 50600-2-4, *Information technology — Data centre facilities and infrastructures — Part 2-4: Telecommunications cabling infrastructure*;

EN 50600-2-5, *Information technology — Data centre facilities and infrastructures — Part 2-5: Security systems*;

EN 50600-3-1, *Information technology — Data centre facilities and infrastructures — Part 3-1: Management and operational information*;

EN 50600-4-1, *Information technology — Data centre facilities and infrastructures — Part 4-1: Overview of and general requirements for key performance indicators*;

EN 50600-4-2, *Information technology — Data centre facilities and infrastructures — Part 4-2: Power Usage Effectiveness*;

EN 50600-4-3, *Information technology — Data centre facilities and infrastructures — Part 4-3: Renewable Energy Factor*;

CLC/TR 50600-99-1, *Information technology — Data centre facilities and infrastructures — Part 99-1: Recommended practices for energy management*;

CLC/TR 50600-99-2, *Information technology — Data centre facilities and infrastructures — Part 99-2: Recommended practices for environmental sustainability;*

CLC/TR 50600-99-3, *Information technology — Data centre facilities and infrastructures — Part 99-3: Guidance to the application of EN 50600 series*.

The inter-relationship of the documents within the EN 50600 series is shown in Figure 1.

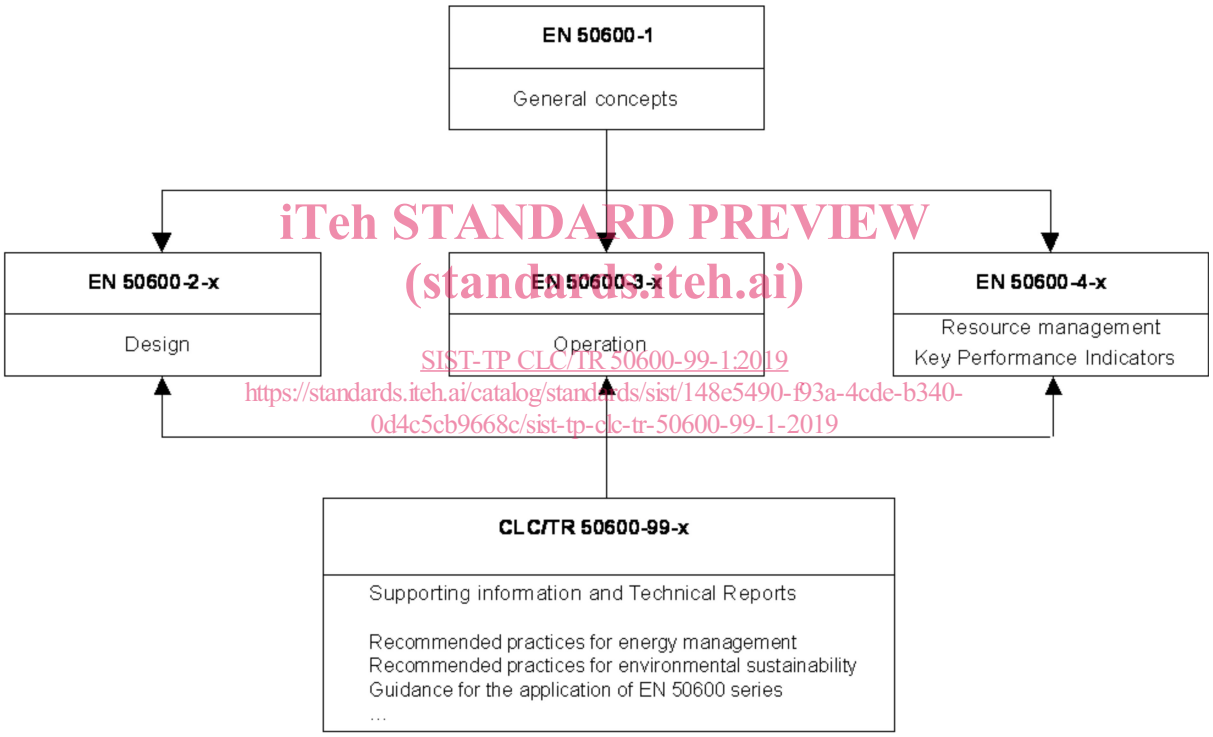

Figure 1 — Schematic relationship between the EN 50600 series of documents

EN 50600-2-X documents specify requirements and recommendations for particular facilities and infrastructures to support the relevant classification for “availability”, “physical security” and “energy efficiency enablement” selected from EN 50600-1.

EN 50600-3-X documents specify requirements and recommendations for data centre operations, processes and management.

EN 50600-4-X documents specify requirements and recommendations for key performance indicators (KPIs) used to assess and improve the resource usage efficiency and effectiveness, respectively, of a data centre.

The Directorate-General Joint Research Centre (DG JRC) of the European Commission operates a Code of Conduct for Data Centre Energy Efficiency (CoC) scheme. In support of the scheme, a “best practices” document has been established by DG JRC. To enhance the visibility, these Best Practices have been converted in this Technical Report to create recommended Practices for improving the

energy management (i.e. reduction of energy consumption and/or increases in energy efficiency) of data centres.

The areas addressed are:

— physical building;

— mechanical and electrical equipment;

— computer room;

— cabinets/racks;

— ICT equipment;

— operating systems;

— virtualization;

— software;

— business practices.

The Practices are separated into Expected Practices as referenced in the CoC (see Clause 5) and other Practices which can be employed as optional or alternative solutions in particular cases (see Clause 6). Practices under consideration for the next or future revision/amendment of this Technical Report are included in Clause 7. During the maintenance of this Technical Report, the Practices of Clauses 6 and 7 might be augmented and others might migrate into Clause 5.

The Practices listed in Clauses 5, 6 and 7 are referenced as x.yyy where x is the clause number and yyy is a sequential number starting within each (sub-)clause.

Customers or suppliers of information and communication technology (ICT) services might also find it useful to request or provide a list of the Practices of this Technical Report that are implemented in a data centre to assist in procurement of services that meet their environmental or sustainability standards.

This Technical Report also:

— acts as an education and reference document to assist data centre operators in identifying and implementing measures to improve the energy management of their data centres;

— provides a common terminology and frame of reference for describing an energy management practice, avoiding doubt or confusion over terminology.

1 Scope

This document is a compilation of recommended Practices for improving the energy management (i.e. reduction of energy consumption and/or increases in energy efficiency) of data centres. It is historically aligned with the EU Code of Conduct for Data Centre Energy Efficiency (CoC) scheme operated by the Directorate-General Joint Research Centre (DG JRC) of the European Commission (EC).

It is recognized that the Practices included might not be universally applicable to all scales and business models of data centres or be undertaken by all parties involved in data centre operation, ownership or use.

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.

EN 50600-1:2012, *Information technology — Data centre facilities and infrastructures — Part 1: General concepts*

EN 50600 (series), *Information technology — Data centre facilities and infrastructures*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions in the EN 50600 series and the following apply.

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
airflow pathway
route taken by air to reach a specific point

3.1.2
albedo
diffuse reflectivity or reflecting power of a surface

3.1.3
availability
ability of an item to be in a state to perform a required function under given conditions at a given instant of time or over a given time interval, assuming that the required external resources are provided

[SOURCE: EN 50600-1:2012, 3.1.1]

3.1.4
cable management system
system used for the support and/or containment, retention, protection of all types of cables, information and communication lines, electrical power distribution conductors and their associated accessories (includes ducts and tubes housing, or intended to house, blown information technology cables and/or cable elements)

[SOURCE: EN 50174-1:2018, 3.1.9]

3.1.5
co-location data centre
data centre in which multiple customers locate their own network(s), servers and storage equipment

Note 1 to entry: The support infrastructure of the building (such as power distribution and environmental control) is provided as a service by the data centre operator.

[SOURCE: EN 50600-1:2012, 3.1.6]

3.1.6
computer room space
area within the data centre that accommodates the data processing, data storage and telecommunication equipment that provides the primary function of the data centre

[SOURCE: EN 50600-1:2012, 3.1.7]

3.1.7
computer room air conditioning/computer room air handling CRAC/CRAH
equipment that provides cooling airflow volumes into a computer room as a means of environmental control

Note 1 to entry: Other abbreviations such as CCU, DFU, RACU, UFU are sometimes used to refer to such equipment.

3.1.8
cooling economizer
system to enable the use of cool external condition to provide cooling to internal data centre spaces without the use of mechanical cooling or refrigeration

Note 1 to entry: Also referenced as “free cooling”.

Note 2 to entry: Free cooling / economised cooling designs take advantage of cool ambient conditions to meet part or all of the facilities’ cooling requirements so that the dependency on any form of mechanical cooling including compressors is reduced or even removed entirely, which can result in significant energy reduction.

Note 3 to entry: The opportunities for the utilization of free cooling are increased in cooler and dryer climates and where increased temperature set points are used. Where refrigeration plant can be reduced in size (or eliminated), operating and capital cost are reduced, including that of the required supporting electrical infrastructure.

Note 4 to entry: Free cooling can be retrofitted to some facilities.

3.1.9
data centre
structure, or group of structures, dedicated to the centralized accommodation, interconnection and operation of information technology and network telecommunications equipment providing data storage, processing and transport services together with all the facilities and infrastructures for power distribution and environmental control together with the necessary levels of resilience and security required to provide the desired service availability

Note 1 to entry: A structure can consist of multiple buildings and/or spaces with specific functions to support the primary function.

Note 2 to entry: The boundaries of the structure or space considered the data centre which includes the information and communication technology equipment and supporting environmental controls can be defined within a larger structure or building.

[SOURCE: EN 50600-1:2019, 3.1.9]

3.1.10
direct liquid-cooled ICT equipment
ICT equipment that is cooled by a direct flow of liquid into an equipment cabinet or directly to the ICT equipment chassis to provide cooling rather than the use of moving air

3.1.11
energy efficiency
measure of the work done (as a result of design and/or operational procedures) for a given amount of energy consumed

3.1.12
energy management
combination of reduced energy consumption and increased energy efficiency, re-use of energy and use of renewable energy

Note 1 to entry: See also EN 50600–3–1 for another definition of energy management.

3.1.13
enterprise data centre
data centre that is operated by an enterprise which has the sole purpose of the delivery and management of services to its employees and customers

[SOURCE: EN 50600-1:2012, 3.1.14]

3.1.14
grid (technology)
interconnection of ICT resources in multiple locations to achieve a common objective

3.1.15
hot aisle/cold aisle (system)
construction of cabinets and containment intended to prevent the mixing of ICT equipment intake and exhaust air within computer room space(s)

3.1.16
information and communication technology (ICT) equipment
information technology (IT) and network telecommunications (NT) equipment providing data storage, processing and transport services

Note 1 to entry: Representing the “critical load” of the data centre.

3.1.17
insolation
total amount of solar radiation energy received on a given surface area during a given time

3.1.18
make-up air
air introduced into a data centre space to replace air that is exhausted through ventilation or combustion processes

3.1.19
managed service
data centre operated to provide a defined set of services to its clients either proactively or as the managed service provider (not the client) determines that services are needed

3.1.20
rack
open construction, typically self-supporting and floor-mounted, for housing closures and other information technology equipment

[SOURCE: EN 50174-1:2018, 3.1.34]

3.1.21
resilience
capacity to withstand failure in one or more of the ICT equipment or data centre infrastructures

3.1.22
set-point
desired or target value (maximum or minimum) for either temperature or humidity

3.1.23
virtualization
creation of a virtual version of physical ICT equipment or resource to offer a more efficient use of ICT hardware

3.2 Abbreviations

For the purposes of this document, the following abbreviations apply in addition to those of the EN 50600 series.

AC	Alternating current
ASHRAE	Formerly “American Society of Heating, Refrigeration and Air conditioning Engineers”
BIOS	Basic input/output system
BREEAM	Building Research Establishment Environmental Assessment Methodology
CoC	EC DG JRC Code of Conduct for Data Centre Energy Efficiency
CRAC/CRAH	Computer room air conditioning/computer room air handling
DC	Direct current
DCiE	Data centre infrastructure efficiency
DCIM	Data centre infrastructure management
DG JRC	Directorate-General Joint Research Council of the European Commission
DX	Direct expansion
EC	European Commission
ICT	Information and communications technology
IP	Internet protocol

IT	Information technology
ITIL	Information Technology Infrastructure Library
LCA	Life cycle assessment
LEED	Leadership in Energy and Environmental Design
MERV	Minimum Efficiency Reporting Value
NT	Network telecommunications
PDU	Power distribution unit
PSU	Power supply unit
PUE	Power usage effectiveness
REF	Renewable Energy Factor
SERT™	Server Efficiency Rating Tool
SLA	Service level agreement
SMASH	Systems Management Architecture for Server Hardware
SNMP	Simple network management protocol
SPEC	Standard Performance Evaluation Corporation
UPS	Uninterruptible power supply

4 Principles

4.1 General

Clauses 5 to 7 contain the full list of energy management Practices of this Technical Report.

Clause 5 contains those Practices that are considered “Expected Practices” of the CoC and which are listed under the following situations:

a) existing data centres (example);

b) ICT equipment (new or replacement);

c) software install or upgrade;

d) new build or refurbishment of data centres.

Clause 6 contains those Practices that are considered as optional or alternative. within the CoC scheme.

Under each heading the recommended Practices of Clauses 5 and 6 are based upon the categories described in 4.2 to 4.8.

Each practice has been assigned a qualitative value (1 to 5) to indicate the level of benefit to be expected from its implementation and, therefore, the relative priorities that should be applied to it. A value of 5 indicates the greatest benefit/priority.

These values are not intended to be totalled or aggregated to provide an overall ‘operator score’ and should not be mistaken as being quantitative. This would require large scale data on the effects of each practice or technology which is not yet available as well as a complex system of scoring representing the combinational increase or reduction of individual practice values within that specific facility.