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**Access, Terminals, Transmission and Multiplexing (ATTM);**
**Broadband Deployment and Lifecycle Resource Management;**
**Part 2: ICT Sites**

Reference
REN/ATTM-002

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# Foreword

This draft European Standard (EN) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document is part 2 of a multi-part deliverable, covering lifecycle resource management of broadband deployment as identified below:

ETSI EN 305 174-1: "Overview, common and generic aspects";

**ETSI EN 305 174-2: "ICT Sites";**

ETSI TS 105 174-4: "Access Networks";

ETSI EN 305 174-5: "Customer network infrastructures";

ETSI TS 105 174-6: "Cable Access Networks";

ETSI TS 105 174-7: "Digital multiservice cities";

ETSI EN 305 174-8: "Management of end of life of ICT equipment (ICT waste / end of life)".

Other documents are planned for development to extend this multi-part deliverable. These are listed in annex B and are mentioned in the present document.

| **Proposed national transposition dates** | |
|---|---|
| Date of latest announcement of this EN (doa): | 3 months after ETSI publication |
| Date of latest publication of new National Standard or endorsement of this EN (dop/e): | 6 months after doa |
| Date of withdrawal of any conflicting National Standard (dow): | 6 months after doa |

# Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

# Introduction

The increasing interaction between the different elements of the Information Communication Technology (ICT) sector (hardware, middleware, software and services) supports the concept of convergence in which:

- multi-service packages can be delivered over a common infrastructure;
- a variety of infrastructures is able to deliver these packages;
- a single multi-service-package may be delivered over different infrastructures.

As a result of this convergence, the development of new services, applications and content has resulted in:

- an increased demand for bandwidth, reliability, quality and performance, with a consequent increase in the demand for power which has implications for cost and, in some cases, availability;
- an associated continuous evolution of ICT equipment.

It is therefore important to consider the environmental viability of all network elements necessary to deliver the required services in terms of the management of their operational aspects i.e. energy management (including energy efficiency) and the management of the End-of-Life (EoL) of the ICT equipment.

NOTE: The term "environmental viability" is used while recognizing that well established treatments of "sustainability" feature three separate viability objectives (environmental, economic and social). For the purposes of this multi-part deliverable only operational aspects of environmental viability are considered. A wider approach to environmental viability takes other factors into account including the use of raw materials and avoidance of hazardous substances in the construction of infrastructure or ICT equipment- these factors are not considered.

New technologies and infrastructure strategies are expected to enable operators to decrease the energy consumption, for a given level of service, of their existing and future infrastructures, thus decreasing their costs. This requires a common understanding among market participants that only standards can produce.

This multi-part deliverable specifies the general engineering of various broadband infrastructures to enable the most effective energy management (and management of other resources) and the appropriate measures for EoL treatment of ICT equipment. Certain of the standards may specify requirements for interoperability.

The present document is part 2 of a multi-part deliverable and specifies requirements for ICT sites within broadband deployment infrastructures.

The present document has been produced by ETSI Technical Committees Access, Terminals, Transmission and Multiplexing (ATTM) and Cable in close collaboration with CENELEC, via the Installations and Cabling Co-ordination Group (ICCG).

# 1 Scope

The present document is part 2 of a multi-part deliverable which specifies the general engineering of various broadband infrastructures to enable the most effective energy management (and management of other resources) and the appropriate measures for EoL treatment of ICT equipment.

The present document specifies the requirements for resource management of ICT sites, as a combination of:

- energy management;
- management of the End-of-Life (EoL) procedures for ICT equipment by reference to ETSI EN 305 174-8 [1].

# 2 References

## 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI EN 305 174-8: "Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment and Lifecycle Resource Management; Part 8: Management of end of life of ICT equipment (ICT waste / end of life)".

[2] ETSI EN 305 200-2-1: "Access, Terminals, Transmission and Multiplexing (ATTM); Energy management; Operational infrastructures; Global KPIs; Part 2: Specific requirements; Sub-part 1: ICT Sites".

## 2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] CEN EN 15978: "Information Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method".

[i.2] CENELEC CLC/TR 50600-99-1: "Information technology - Data centre facilities and infrastructures - Part 99-1: Recommended practices for energy management".

[i.3] CENELEC EN 50600-1: "Information technology - Data centre facilities and infrastructures - Part 1: General concepts".

[i.4] CENELEC EN 50600-2-2: "Information technology - Data centre facilities and infrastructures - Part 2-2: Power supply and power distribution".

[i.5] CENELEC EN 50600-2-3: "Information technology - Data centre facilities and infrastructures - Part 2-3: Environmental control".

[i.6] CENELEC EN 50600-2-4: "Information technology - Data centre facilities and infrastructures - Part 2-4: Telecommunications infrastructure".

[i.7] CENELEC EN 50600-4-2: "Information technology - Data centre facilities and infrastructures - Part 4-2: Power usage effectiveness".

[i.8] CENELEC EN 50600-4-3: "Information technology - Data centre facilities and infrastructures - Part 4-3: Renewable energy factor".

[i.9] ISO EN 14001: "Environmental management systems. Requirements with guidance for use".

[i.10] ISO EN 14040: "Environmental management. Life cycle assessment. Principles and framework".

[i.11] ISO EN 14044: "Environmental management. Life cycle assessment. Requirements and guidelines".

[i.12] ISO EN 50001: "Energy management systems. Requirements with guidance for use".

[i.13] ETSI EN 305 200-3-1: "Access, Terminals, Transmission and Multiplexing (ATTM); Energy management; Operational infrastructures; Global KPIs; Part 3: ICT Sites; Sub-part 1: DCEM".

[i.14] ETSI TS 105 174-2: "Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment and Energy Management; Part 2: ICT sites".

[i.15] EU Code of Conduct for AC Uninterruptible Power Supplies.

[i.16] ISO/IEC 20000 series: "Information technology. Service management".

[i.17] CENELEC EN 50600-3-1: "Information technology - Data centre facilities and infrastructures - Part 3-1: Management and operational information".

[i.18] Mandate M/462: "Standardisation mandate addressed to CEN, CENELEC and ETSI in the field of ICT to enable efficient energy use in fixed and mobile information and communication networks".

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**access network:** functional elements (that is equipment and infrastructure) that enable communication between an Operator Site (OS) and a customer network

**Base Station (BS):** network telecommunications equipment which serves one or more cells within a coverage area of a mobile network

**base station site:** Network Distribution Node (NDN) which accommodates a base station

**core network:** functional elements (that is equipment and infrastructure) that enable communication between Operator Sites (OSs) or equivalent ICT sites

**End-of-Life (EoL):** established point in a product life cycle after a period of primary use and at which a decision is required with regard to reuse, recycling or disposal

**free cooling:** use of low temperatures, external to the ICT site, to reduce or eliminate the need for powered refrigeration

**ICT equipment:** equipment providing data storage, processing and transport services

NOTE: A combination of Information Technology Equipment and Network Telecommunications Equipment.

**ICT site:** site containing structures or group of structures dedicated to the accommodation, interconnection and operation of ICT equipment 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

**Information Technology Equipment (ITE):** equipment providing data storage, processing and transport services for subsequent distribution by Network Telecommunications Equipment (NTE)

**Last Operators Connection point (LOC):** interface to the fixed access transport networks of one or more operators from which cabling is routed to a customer network

**mobile access network:** telecommunications network in which the access to the network (connection between user equipment and network) is implemented over the air interface

**Network Data Centre (NDC):** data centre embedded within the core network

NOTE: A network data centre of a cable access network may be termed a master head-end.

**Network Telecommunications Equipment (NTE):** equipment between the boundaries of, and dedicated to providing connection to, core and/or access networks

**Operator Site (OS):** premises accommodating Network Telecommunications Equipment (NTE), providing direct connection to the core and access networks, and which may also accommodate Information Technology Equipment (ITE)

NOTE 1: An operator site that is only connected to the core network is considered as a network data centre.

NOTE 2: An operator site of a cable access network may be termed a local head-end.

**Terminal Equipment (TE):** principal device within customer premises allowing user access to the services provided by the fixed access network

**User Equipment (UE):** device allowing user access to the services provided by the mobile access network

## 3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

| | |
|---|---|
| AC | Alternating Current |
| ATTM | Access, Terminals, Transmission and Multiplexing |
| BS | Base Station |
| CEN | European Committee for Standardization |
| CENELEC | European Committee for Electrotechnical Standardization |
| CLC | CENELEC |
| CLC/TR | CENELEC Technical Report |
| CP | Customer Premises |
| CRAC | Computer Room Air Conditioning |
| CRAH | Computer Room Air Handling |
| EoL | End-of-Life |
| EU | European Union |
| ICCG | CENELEC/ETSI Installations and Cabling Co-ordination Group |
| ICT | Information Communications Technology |
| IEC | International Electrotechnical Committee |
| ISO | International Standards Organization |
| IT | Information Technology |
| ITE | Information Technology Equipment |
| ITIL | Information Technology Infrastructure Library |
| KPI | Key Performance Indicator |
| LCA | Life Cycle Analysis |
| LOC | Last Operators Connection point |
| NDC | Network Data Centre |
| NTE | Network Telecommunications Equipment |
| OS | Operator Site |
| PUE | Power Usage Effectiveness |

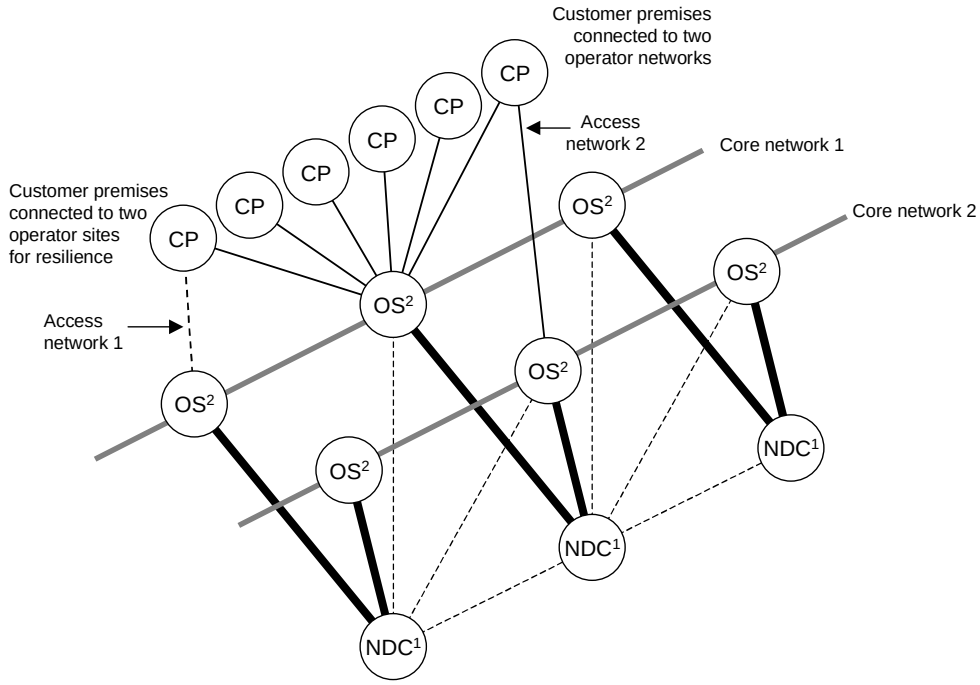
| | |
|---|---|
| TE | Terminal Equipment |
| TRX | Transceiver Equipment |
| UE | User Equipment |
| UPS | Uninterruptible Power Supply |

# 4 Broadband deployment and ICT sites

## 4.1 ICT sites

### 4.1.1 General

Figure 1 is a technology-agnostic diagram depicting a segment of a broadband network showing the interconnection of ICT sites and customer premises installations for fixed access networks. In principle, every operator network can contain any number of each of these elements and may be connected to any number of other operator networks.




[1] For cable access networks this is termed “Master head-end/OS”
[2] For cable access networks this is termed “Local head-end/OS”

**Figure 1: Network sub-systems of fixed broadband access network infrastructure**

Figure 2 is a technology-agnostic diagram depicting a segment of a broadband network showing the interconnection of ICT sites and base stations (BS) for mobile access networks. Each BS may provide services to a variable number of "end-use IT equipment" shown as User Equipment (UE) in Figure 2.

In principle, every operator network can contain any number of each of these elements and may be connected to any number of other operator networks.

Broadband provision is an enabling technology capable of supporting a reduction of global energy consumption.

EXAMPLE: By providing facilities such as home working and video conferencing to reduce travel demands.

For this reason, it may not be the case that the total energy consumption of broadband networks will be reduced, though the application of effective energy efficiency measures will minimize any increases due to predicted service evolution.

The scale of reductions in energy consumption and/or improvements of energy efficiency is:

- dependent on the network sub-systems;
- generally greater at the design stage rather than following improvements to existing infrastructures.

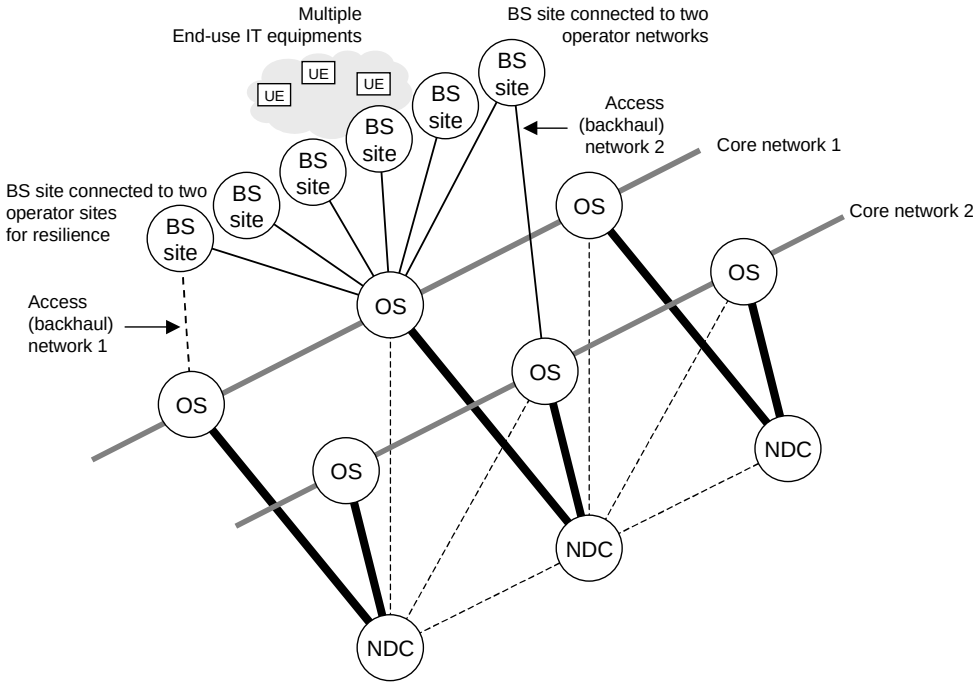



**Figure 2: Network sub-systems of mobile broadband access network infrastructure**

ICT sites comprise Operator Sites (OS) as described in clause 4.1.2 and Network Data Centres (NDC) as described in clause 4.1.3. The present document addresses OS and NDC and does not differentiate between them. It should be noted that an OS that is only connected to the core network is considered to be an NDC.

The potential reductions in energy consumption and/or improvements of energy efficiency in ICT sites as described in clauses 4.1.2 and 4.1.3 are expected to be substantial but apply in only a relatively small number of locations and may prove vital where availability of power is restricted. These clearly defined premises are provided with appropriate Key Performance Indicators (KPIs) to determine relative performance levels in terms of energy efficiency.

Within customer premises, it is generally the customer rather than the operator who funds the energy costs. Potential reductions in energy consumption may well be identifiable in design terms but they are generally not individually quantifiable due to the diversity of customer networks.

## 4.1.2 Operator Site (OS)

NOTE: This is equivalent to the master head-end for a cable access network.

With reference to Figure 1 and Figure 2, an OS is the network sub-system in the core network that enables the connectivity between network data centres and customer premises over which the required services can be delivered, using the access network. An OS also enables indirect connectivity between customer premises. An OS will almost invariably each serve many thousands of customer connections. Each customer connection may be comprised of multiple communication paths and serve a variety of applications.

## 4.1.3 Network Data Centre (NDC)

NOTE 1: This is equivalent to the local head-end for a cable access network.

With reference to Figure 1 and Figure 2, an NDC is a network sub-system serving the core network of one or more operators. Its functions include the storage, processing and dissemination of data as required to fulfil customer expectations, the hosting of the necessary applications, content hosting, etc.

To enable their functionality, each NDC shall be connected to at least one core network OS. For reasons of network resilience, an NDC will invariably be connected to more than one OS and to several other NDCs. An NDC may serve core networks operated by several network operators, thus enabling traffic between customers of different network operators.

NOTE 2: This description of an NDC excludes any locations containing servers and their related hardware that are used solely for administrative functions such as customer management functions, billing, etc.

## 4.2 Element of ICT sites

### 4.2.1 ICT equipment

Figure 3 shows the content and external connectivity of a typical OS and NDC in some detail though this diagram is intended only to illustrate the types of equipment employed, not its internal connectivity.

The primary objective of an ICT site is to deliver the required overall availability of ICT services to the customer premises and/or other parts of the core network.

The overall availability of the ICT site is not only dependent on the design and configuration of the ICT equipment but also on the following support infrastructures:

- power supply and power distribution (see clause 4.2.2);
- environmental control (see clause 4.2.3);
- telecommunications cabling infrastructure (see clause 4.2.4);
- security systems (see clause 4.2.5).

Figure 3 seeks to identify the difference between Information Technology Equipment (ITE) and Network Telecommunications Equipment (NTE) accommodated in the ICT sites.

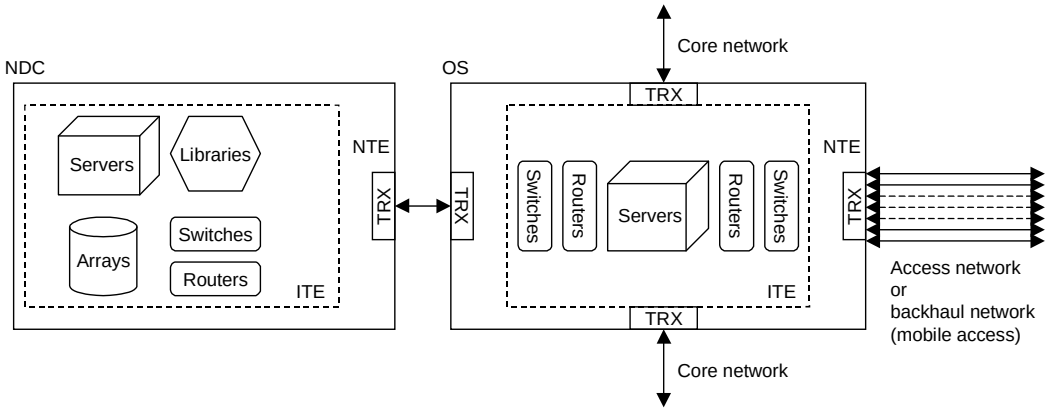



**Figure 3: Schematic of ICT sites composition and connectivity**

For the purposes of the ETSI EN 305 174 series, the boxes marked 'TRX' will be regarded as part of the access or core network, as appropriate, and their power requirements included in the assessments for those networks.

### 4.2.2 Power supply and power distribution

The power supply to an ICT site and the power distribution within the ICT site are critical to the operation of the ICT site.

Interruptions of supply to ICT equipment which is not otherwise protected will result in the failure of that equipment. The timescale of such a damaging interruption is in the millisecond range whilst the recovery of service from the ICT equipment will depend upon its design and configuration.

As a result, the design of the power supply and power distribution systems (and the security of spaces and pathways accommodating those systems) needs to prevent such interruptions to a degree consistent with the objectives for overall availability of the ICT site (see clause 4.3).

### 4.2.3 Environmental control

ICT equipment within ICT sites has specific requirements for operating environment, typically in terms of temperature and humidity envelopes. Short periods of deviation from the specified conditions may be allowed but extended periods may limit the operational lifetime of the ICT equipment.

Where environmental control systems are required to maintain the required operating conditions, the impact of failure of those systems will depend upon time taken for the actual conditions to breach the specified envelope. This is always significantly longer than the time allowed for interruption of power supply and distribution.

Nevertheless, the design of the environmental control systems (and the security of spaces and pathways accommodating those systems) needs to prevent such interruptions to a degree consistent with the objectives for overall availability of the ICT site (see clause 4.3).

### 4.2.4 Telecommunications cabling infrastructure

Telecommunications cabling in an ICT site provides the:

- connections between ICT equipment;
- connections to the control and monitoring equipment of the supporting infrastructures.

The availability of the services provided by the ICT equipment is a combination of the interconnecting cabling and the design and configuration of the ICT equipment.

The availability of the supporting infrastructures is a combination of the design of those infrastructures with the telecommunications cabling providing control and monitoring - including the measurement of parameters related to the KPIs for energy management.

### 4.2.5 Security systems

The security provided for the spaces and pathways of the ICT site (for all supporting infrastructures) is critical to availability. Security considerations include protection against unauthorized access, fire and other events inside the ICT sites and also external events.

## 4.3 Availability

The quality and reliability of service provision to customer premises is dependent on the overall availability of the ICT site - which ultimately relates to the availability of the ICT equipment. The present document does not address the selection and configuration of ICT equipment in order to maximize availability.

The requirement for overall availability of a given ICT site depends upon the design and configuration of the core and access network. Within each ICT site, the availability of the supporting infrastructures (power supply and distribution, environmental control and telecommunications cabling) is critical to meeting any overall availability objectives.

Clause 5 indicates that the CENELEC EN 50600-2 series of data centre design standards recognizes different availability options for these underpinning infrastructures.

# 5 Standardization review for ICT sites

As indicated in clause 4.1.1, the present document does not differentiate between OSs and NDCs.

CENELEC TC215 has published standards in the CENELEC EN 50600 series generally entitled "Information technology - Data centre facilities and infrastructures". These standards address the design, operation, management and resource management of data centres including:

- General:
  - CENELEC EN 50600-1 [i.3]: General concepts.
- Design:
  - CENELEC EN 50600-2-2 [i.4]: Power supply and distribution;
  - CENELEC EN 50600-2-3 [i.4]: Environmental control;
  - CENELEC EN 50600-2-4 [i.6]: Telecommunications cabling infrastructure.

CENELEC EN 50600-1 [i.3] uses the design solutions of CENELEC EN 50600-2-2 [i.4], CENELEC EN 50600-2-3 [i.5] and CENELEC EN 50600-2-4 [i.6] to define an overall Availability Class for a data centre.

In addition, CENELEC EN 50600-2-2 [i.4] and CENELEC EN 50600-2-3 [i.5] specify requirements for energy efficiency enablement which define locations for the measurement of energy consumption and related parameters. These requirements may be referenced normatively from the KPI standards defined in clause 6.3.

# 6 Requirements for ICT sites

## 6.1 General engineering to support energy management

### 6.1.1 General

Designs with the higher availability classifications (using the criteria of CENELEC EN 50600-1 [i.3] and described in clause 5 of the present document) will generally involve the use of resilient components, sub-systems and systems which consume additional energy without provided additional function. This will generally result in poorer values of energy management KPI.

For a given level of availability, there are design practices which provide the best opportunities to maximize energy management (see clause 6.1.2).

For a given design solution, there are operational practices which provide the best opportunities to further improve energy management (see clause 6.1.3).

These design and operational practices are described in CENELEC CLC/TR 50600-99-1 [i.2] (which is a standard-based version of the Best Practices of the EU Code of Conduct for Data Centre Energy Efficiency) and are exemplified in ETSI TS 105 174-2 [i.14].

### 6.1.2 Design

#### 6.1.2.1 General

A business impact analysis shall be undertaken in order to define the appropriate availability for the ICT site. In order to minimize energy consumption, the design of the physical infrastructure shall meet the minimum requirements necessary to support that availability.

The site infrastructures (including those of clauses 6.1.2.2 and 6.1.2.3) shall be designed to maximize their efficiency under partial and/or variable load conditions.

#### 6.1.2.2 Power supply and distribution

Electrical equipment, other than Uninterruptable Power Supply (UPS) batteries, shall be selected which does not require cooling in normal operation.

Power supply and distribution capacity in excess of that anticipated in the short-term shall not be provisioned.

Where UPS systems are required, they shall be modular (scalable).

Static UPS systems shall be compliant with the EU Code of Conduct for AC Uninterruptible Power Systems [i.15].

NOTE: A conformant UPS is required to perform as rated when operating within a temperature range of 0 °C to 40 °C and a relative humidity range of 20 % to 80 %.

#### 6.1.2.3 Environmental control

Mechanical equipment shall be selected which does not require cooling in normal operation.

Cooling capacity in excess of that anticipated in the short term shall not be provisioned.

Cooling system infrastructures shall be designed to maximize its efficiency under partial load conditions (e.g. variable speed (or frequency) controls shall be sued to optimize energy consumption during changing load conditions).

Cooling designs and solutions shall maximize the use of free cooling taking into consideration site constraints, local climatic conditions or applicable regulations.

Cooling units shall be sized such that they are capable of providing the maximum amount of free cooling to the ICT equipment at the temperature and humidity recommended by the ICT equipment manufacturer(s).

Designs shall incorporate appropriately controlled variable speed fans.

Electrically commutated motors shall be used (and retro-fitted where possible) which are significantly more energy efficient than traditional AC motors across a wide range of speeds.

Where required, humidity control shall be centralized at the ICT site supply computer room air handling (CRAH) unit. Computer Room Air Conditioner (CRAC) and CRAH units shall not be equipped with humidity control capability, or reheat capability, to reduce both capital and on-going maintenance costs.

Mechanical and electrical equipment shall be selected to enable local metering/monitoring of temperature and incorporated within a system that allows for reporting of temperature trends over a period of time as well as instantaneous temperature readings.

#### 6.1.2.4 Lighting

Low energy lighting systems shall be employed in the ICT spaces.

Lighting shall be turned off when spaces are unoccupied.

#### 6.1.2.5 Measurement of energy consumption

Mechanical and electrical equipment shall be selected to enable local metering/monitoring of instantaneous power consumption (kW) and incorporated within a system that allows for reporting cumulative periodic energy consumption (kW/h).

Metering equipment shall be installed that is capable of measuring the total energy consumption of the spaces which comprise the entire site including all ICT, mechanical and electrical equipment.

Metering equipment shall be installed that is capable of measuring the total energy consumed by ICT equipment within the ICT space(s).

### 6.1.3 Operation

#### 6.1.3.1 General

The ICT site shall be subject to a plan for:

a) energy management in accordance with emerging EU guidelines and internationally standardized methodologies;

NOTE 1: ISO EN 50001 [i.12] is an example of a standardized methodology.

b) environmental management in accordance with emerging EU guidelines and internationally standardized methodologies;

NOTE 2: ISO EN 14001 [i.9] is an example of a standardized methodology.

c) life cycle assessment (LCA) in accordance with emerging EU guidelines and internationally standardized methodologies.

NOTE 3: This aims to reduce overall carbon footprint and improve sustainability rather than energy efficiency. ISO EN 14040 [i.10], ISO EN 14044 [i.11] and CEN EN 15978 [i.1] provide useful information.

The ICT site shall maximize the use, consistent with availability objectives, of energy from renewable/sustainable sources. Standardized metrics in this area are available as:

- CENELEC CLC EN 50600-4-3 [i.8] "Renewable Energy Factor";
- ETSI EN 305 200-2-1 [2] which contains an Objective KPI in relation to renewable energy.

The ICT site shall be subject to ongoing, continuous, audits of the existing physical estate to establish what ICT equipment is in place and what service(s) it delivers.

Based on such audits:

a) ICT equipment that is no longer required or used to support discontinued services shall be de-commissioned and, where appropriate, removed;

b) mechanical and electrical equipment that is no longer required or is considered unnecessary shall be de-commissioned and, where appropriate, removed.

#### 6.1.3.2 Power supply and distribution

Electrical equipment shall be subjected to regular maintenance to preserve or achieve a "like-new condition".

#### 6.1.3.3 Environmental control

Mechanical equipment shall be subjected to regular maintenance to preserve or achieve a "like-new condition".

Allowable temperature and humidity ranges for existing installed ICT equipment shall be identified and:

a) the energy consumed by cooling systems shall be the minimum appropriate for these requirements (and not over-supplied);

b) ICT equipment with restrictive intake temperature ranges shall be either:

   i) be marked for replacement as soon as is practicable with equipment capable of a wider intake range; or

   ii) installed within groups of ICT, mechanical and electrical equipment with common environmental requirements.

ICT equipment with different airflow directions shall be installed in separate areas which have independent environmental controls.

The opportunity to optimize the refrigeration cycle set-points of mechanical refrigeration systems to minimize compressor energy consumption shall be regularly evaluated.

Where air cooling is used for ICT equipment:

a) blanking plates shall be installed in locations within cabinets/racks where there is no equipment;

b) ICT equipment shall be aligned in the computer room space(s) in a hot/cold aisle configuration.

#### 6.1.3.4 ICT equipment and software

An ITIL type Configuration Management Database and Service Catalogue shall be implemented in accordance with ISO/IEC 20000 series [i.16].

Energy efficiency performance shall be a high priority criterion when choosing new ICT equipment.

ICT equipment shall perform the required task with the lowest power consumption in the expected environmental conditions.

NOTE 1: The power consumption of the device in normal operating circumstances should be considered in addition to peak performance per Watt.

NOTE 2: EnergyStar, SERT™, SPECpower® or other appropriate performance metrics should be closely aligned to the target environment.

Periodic reviews shall be undertaken to validate the consistency of deployment of ICT equipment with respect to the cooling design and identify and implement appropriate changes.

Software shall use the least energy to perform the required task whilst ensuring that the application fully meets the defined operational needs.

#### 6.1.3.5 Measurement of energy consumption

A system shall be in place to enable the recording of hours throughout the year using both free cooling and powered refrigeration.

Manual or automated measurements shall be made at regular intervals (ideally at peak load) and the following shall be recorded:

- energy consumption;
- temperature and humidity (dry bulb temperature, relative humidity and dew point temperature).

## 6.2 General engineering to support interoperability

For further study.

## 6.3 Monitoring of energy management

The recommended practices of CENELEC CLC/TR 50600-99-1 [i.2] include the recording of Power Usage Effectiveness (PUE) in accordance with CENELEC EN 50600-4-2 [i.7].

The present document requires the Objective KPIs of ETSI EN 305 200-2-1 [2] to be monitored - independent of their use in combination as a Global KPI.

NOTE 1: The Global KPI of ETSI EN 305 200-2-1 [2] is $KPI_{EM}$;

NOTE 2: The Global KPI of ETSI EN 305 200-3-1 [i.13] is $KPI_{DCEM}$.

## 6.4 Managing EoL of ICT equipment

The requirements of ETSI EN 305 174-8 [1] shall be applied.

# Annex A (informative): Recommendations for general engineering

## A.1 General

The present document in conjunction with ETSI TS 105 174-2 [i.14] (see clause 6.1.1) and the documents of the CENELEC EN 50600 series provide a comprehensive set of requirements and recommendations in support of the general engineering of ICT sites.

## A.2 Design

As detailed in clause 5, the CENELEC EN 50600-2 series specify requirements for the design of data centres that can be applied to the wider group of ICT sites considered by the present document. In particular:

- CENELEC EN 50600-2-2 [i.4]: Power supply and distribution;
- CENELEC EN 50600-2-3 [i.5]: Environmental control;
- CENELEC EN 50600-2-4 [i.6]: Telecommunications cabling infrastructure.

These standards do not focus explicitly on resource efficiency or management but define design requirements to enable energy efficiency by means of the appropriate location of meters for energy consumption (CENELEC EN 50600-2-2 [i.4]) and monitoring devices for environmental control (CENELEC EN 50600-2-3 [i.5]). Other standards in the series provides requirements and recommendations in relation to the location, construction and physical security of data centres.

## A.3 Operation

CENELEC EN 50600-3-1 [i.17] specifies requirements and recommendation for the management and operation of data centres. These include monitoring and reporting of energy consumption.

# Annex B (informative): Future structure of this multi-part deliverable

The present document forms part of series of standards which are listed under Phase 2 of Mandate M/462 [i.18].

In addition to the documents listed in the Foreword, the series is intended to include the following:

ETSI EN 305 174-3: "Core, regional metropolitan networks";

ETSI EN 305 174-4: "Access Networks":

Sub-part 1: "Fixed access networks (excluding cable)";

Sub-part 2: "Mobile access networks";

ETSI EN 305 174-5: "Customer network infrastructures":

Sub part 2: "Office premises (single-tenant)";

Sub part 4: "Multi-tenant premises (residential and commercial)";

ETSI EN 305 174-6: "Cable Access Networks".

# History

| Document history | | |
|---|---|---|
| V1.1.1 | October 2009 | Publication as ETSI TR 105 174-2-1 and ETSI TS 105 174-2-2 |
| V1.2.1 | Janvier 2017 | Publication as ETSI TS 105 174-2 |
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