



**Access, Terminals, Transmission and Multiplexing (ATTM);
Energy management;
Global KPIs;
Operational infrastructures;
Part 2: Specific requirements;
Sub-part 1: Data centres**

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Foreword

This final draft ETSI Standard (ES) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM), and is now submitted for the ETSI standards Membership Approval Procedure.

The present document is part 2, sub-part 1 of a multi-part deliverable covering operational energy management and sustainability of broadband deployment, as identified below:

Part 1: "General requirements ";

Part 2: "Specific requirements":

Sub-part 1: Data centres;

Sub-part 2: Fixed (excluding cable) access networks;

Sub-part 3: Mobile access networks;

Sub-part 4: Cable Access Networks;

Part 3: "Monitoring of sustainability".

NOTE 1: Additional documents are in development by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM) which include:

- 205 200-1-1: Energy management: Global KPIs: Operational infrastructures: Guidance (see NWIP DES/ATTM-02025)
- 205 200-2-2: Fixed (other than cable) access networks (see NWIP DES/ATTM-02026)
- 205 200-3: Monitoring of other environmental viability aspects of sustainability (see NWIP DES/ATTM-02027)

NOTE 2: A further document is under consideration ETSI Technical Committee CABLE to address "cable access networks".

Introduction

Energy costs continue to rise, a trend that will continue in the future, while broadband penetration is introducing new active equipment to the network architecture. In this context, and to reflect other environmental aspects of sustainability, it is vital that the main telecommunication actors implement effective general engineering of fixed and mobile broadband networks and sites provisioning, managing or using those networks (i.e. operator sites, operator data centres and customer data centres) in order to respond to critical issues of energy consumption while proposing essential solutions to true broadband deployment.

These issues are of particular importance in data centres - both of operators **and** customers. To guide this process, it is essential that metrics are defined, termed Global Key Performance Indicators (KPI_{EM}) that enable energy usage to be managed more efficiently.

This multi-part deliverable comprises:

- ES 205 200-1 [2]: a generic requirements document addressing Global KPIs for operational infrastructures;

NOTE: Global KPIs do not address design/operation of components or subsystems of broadband deployment networks.

- a sub-series ES 205 200-2 [i.10] that defines the Global KPIs, and drives energy management targets, for specific operational networks and sites and which describes how the Global KPIs are to be applied (which may be used to support future regulatory objectives);
 - ES 205 200-2-1: Data centres;
 - ES 205 200-2-3: Mobile access networks.

These documents do not define KPI limits or targets (which is outside the scope of this multi-part deliverable).

These documents will accelerate:

- availability of operational infrastructure architectures and network implementations that use energy more efficiently;
- the definition and attainment of sustainability objectives for operational broadband networks.

Within the present document:

- clause 4 explains the definition of a data centre in terms of the systems it comprises and the boundaries that apply and shows that the present document is equally applicable to operator data centres, operator sites and customers data centres;
- clause 5 describes how the Objective KPIs of the present document meet the requirements of ES 205 200-1 [2];
- clause 6 describes the specific requirements of the Global KPI and the supporting Objective KPIs for data centres;
- annex A discusses the roles of different types of Key Performance Indicators i.e. Technical, Objective and Global in relation to the overall energy management concepts of the present document.

The comparative costs and environmental impacts of different energy sources are not addressed in the present document.

1 Scope

The present document specifies Global Key Performance Indicators (KPI_{EE}) in relation to energy management for operator data centres (ODC), operator sites (OS) and customer data centres (CDC) and addresses the following objectives:

- energy consumption;
- task efficiency;
- energy re-use;
- renewable energy.

The definition of the Global KPIs (clause 6) are in accordance with requirements of ES 205 200-1 [2] (as described in clause 5) in relation to:

- infrastructure scalability;
- infrastructure evolution;
- formulae and definitions of terms;
- measurement points and procedures.

The present document also provides information on system definition and boundaries (clause 4).

The comparative costs and environmental impacts of different energy sources are outside the scope of the present document.

2 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 reference 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.

2.1 Normative references

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

- [1] CENELEC EN 50600-2-2: "Information technology - Data centre facilities and infrastructures - Part 2-2: Power distribution".
- [2] ETSI ES 205 200-1: "Access, Terminals, Transmission and Multiplexing (ATTM); Energy management; Global KPIs; Operational infrastructures; Part 1: General requirements".
- [3] CEN EN 1434 series: "Heat Meters".

2.2 Informative references

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] CENELEC EN 50600-1: "Information technology - Data centre facilities and infrastructures - Part 1: General requirements".
- [i.2] EC Mandate M/462; "Standardisation mandate addressed to CEN, CENELEC and ETSI in the field of Information and Communication Technologies".
- [i.3] ETSI TR 105 174-2-2: "Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment and Energy Management; Part 2: Network sites; Sub-part 2: Data centres".
- [i.4] European Commission DG JRC Code of Conduct for Data Centre Energy Efficiency.
- [i.5] Recommendation ITU-T L.1300: "Series L: Construction, installation and protection of cables and other elements of outside plant: Best practices for green data centers".
- [i.6] European Commission DG JRC Code of Conduct on Energy Consumption of Broadband Equipment.
- [i.7] ISO Guide 82: "Guide for addressing sustainability in standards".
- [i.8] ETSI TR 105 174-1: "Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment and Energy Management; Part 1: Overview, common and generic aspects".
- [i.9] ETSI ES 205 200 (all parts): "Access, Terminals, Transmission and Multiplexing (ATTM); Energy management; Global KPIs; Operational infrastructures".
- [i.10] ETSI ES 205 200-2 (all parts): "Access, Terminals, Transmission and Multiplexing (ATTM); Energy management; Global KPIs; Operational infrastructures; Part 2: Specific requirements".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

core infrastructure (core network): functional elements (that is equipment and infrastructure) that enable communication between operator sites and/or operator data centres

NOTE: See TR 105 174-1 [i.8].

customer data centre: data centre that is not directly connected to the core network

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

energy consumption: total consumption of electrical energy by an operational infrastructure

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

energy re-use: transfer or conversion of energy (typically in the form of heat) produced by the operational infrastructure to do other work

fixed access network: functional elements that enable wired (including optical fibre) communications to customer equipment

Information Technology Equipment (ITE): equipment providing data storage, processing and transport services for subsequent distribution by network telecommunications equipment

ITE and/or NTE load: total requirement for power by a set of information technology equipment (ITE) and/or network telecommunications equipment (NTE)

mobile access network: functional elements that enable wireless communications to customer equipment

Network Telecommunications Equipment (NTE): equipment dedicated to providing direct connection to core and/or access networks

objective KPI: KPI assessing one of the objectives of operational energy performance which is subsequently used to define a Global KPI for energy management (KPI_{EM})

operational infrastructure: combination of information technology equipment (ITE) and/or network telecommunications equipment (NTE) together with the power supply and environmental control systems necessary to ensure provision of service

operator data centre: data centre embedded within the core network

operator site: premises accommodating network telecommunications equipment providing direct connection to the core and access networks and which may also accommodate information technology equipment

primary distribution equipment: equipment which is required to manage, control and convert incoming power supplies (primary, secondary and, where appropriate, additional) in a form suitable for distribution by secondary distribution equipment

NOTE: See EN 50600-2-2 [1].

renewable energy: energy produced from dedicated generation systems using resources that are naturally replenished

secondary distribution equipment: equipment which is required to manage, control and distribute the power provided by the primary distribution equipment to the short-break and unprotected sockets within the data centre and to the tertiary distribution equipment

NOTE 1: See EN 50600-2-2 [1].

NOTE 2: The power supply may be single-phase AC, three-phase AC or DC. If there is a change from 3-phase to 1-phase supply, this is generally achieved at the secondary distribution equipment that is served directly from the primary distribution equipment.

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

3.2 Symbols

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

| | |
|---------------|---|
| Δt | the maximum time variation between measurement points of the different Objective Key Performance Indicators within a given Global Key Performance Indicator |
| KPI_{EC} | Objective Key Performance Indicator of energy consumption |
| KPI_{EM} | Global Key Performance Indicator of energy management |
| KPI_{REN} | Objective Key Performance Indicator of renewable energy usage |
| KPI_{REUSE} | Objective Key Performance Indicator of energy re-use |
| KPI_{TE} | Objective Key Performance Indicator of task efficiency |
| T_{KPI} | period of time over which Objective KPIs are assessed |
| T_{REPEAT} | the minimum time between which the Objective KPIs can be assessed to determine relevant trend information |
| W_{EC} | weighting factor applied to KPI_{EC} |
| W_L | weighting factor within KPI_{REUSE} |
| W_{REN} | weighting factor applied to KPI_{REN} |
| W_{REUSE} | weighting factor applied to KPI_{REUSE} |
| W_{TE} | weighting factor applied to KPI_{TE} |

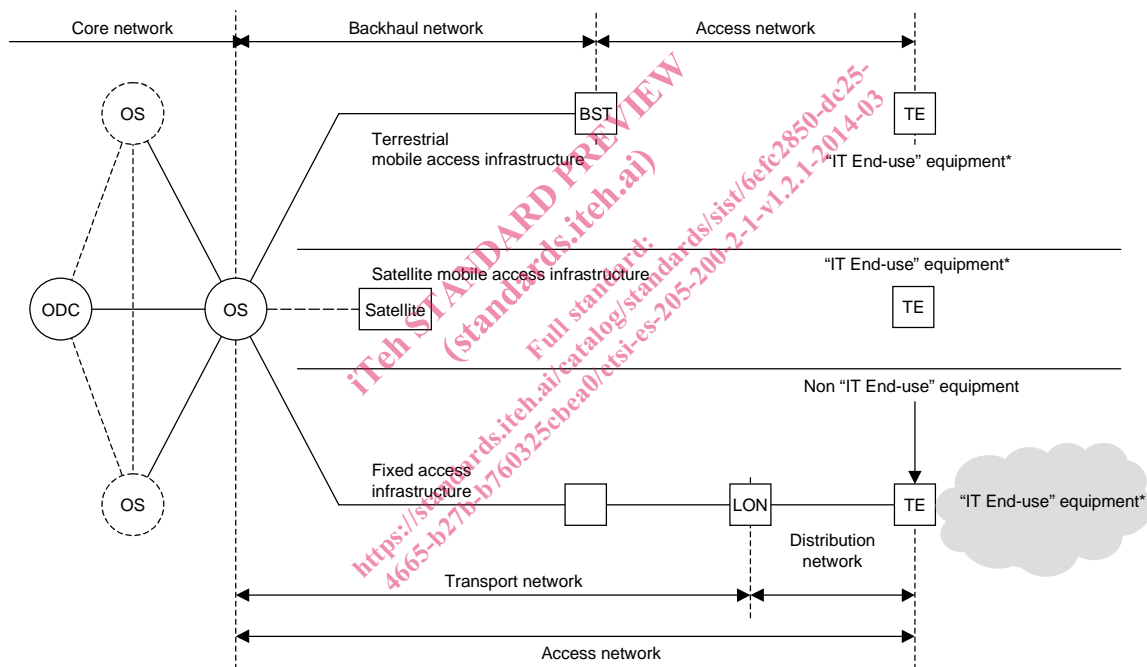
3.3 Abbreviations

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

| | |
|-----|--------------------------------------|
| CDC | Customer Data Centre |
| ffs | for further study |
| ITE | Information Technology Equipment |
| KPI | Key Performance Indicator |
| NTE | Network Telecommunications Equipment |
| ODC | Operator Data Centre |
| OS | Operator Site |
| PDU | Power Distribution Unit |
| UPS | Uninterruptible Power Supply |

4 System definition and boundaries

Figure 1 shows the schematic of the operational infrastructures of broadband deployment as contained with the ESO response to the EC Mandate M/462 [i.2].



* out of scope of Mandate M/462

NOTE: Not all the terms and abbreviations of Figure 1 are included in clause 3 of the present document.

Figure 1: Schematic of core network together with fixed and mobile access infrastructures

With reference to Figure 1:

- an operator data centre (ODC) accommodates a mixture of information technology equipment (ITE) and network telecommunication equipment (NTE);
- an operator site (OS) will also accommodate a mixture of ITE and NTE - where the NTE may provide connections to connections to core, fixed access, terrestrial mobile access and satellite mobile access network infrastructures.

It is unlikely that either the ODC or OS of Figure 1 would allow separate assessment of energy consumption of the ITE and the various NTE for the disparate network infrastructures. As a result, the boundaries applied to ODC and OS in relation to the objective of Global KPIs for operational infrastructures have to be modified from that of Figure 1 to that shown in Figure 2.