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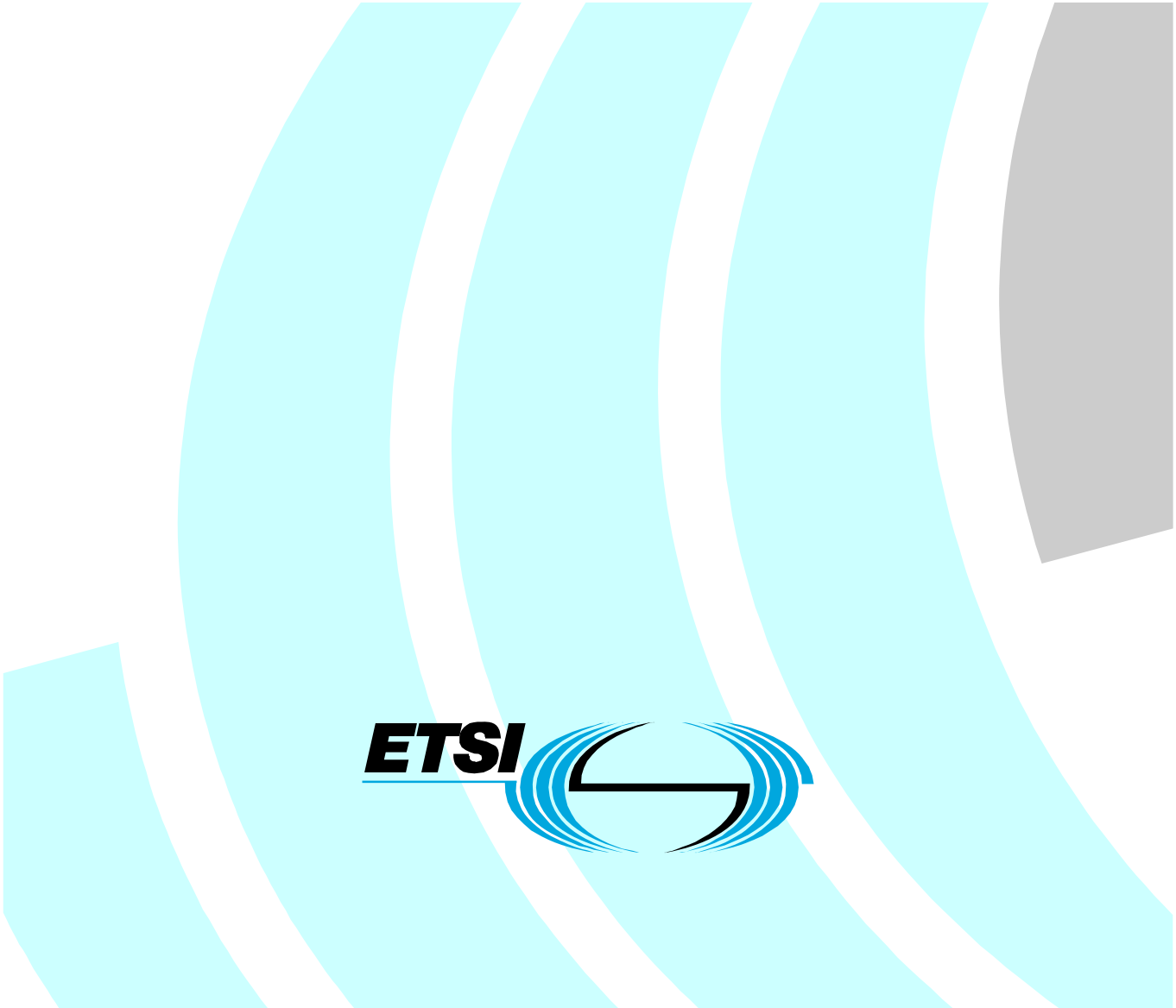
Technical Report

**Access, Terminals,Transmission and Multiplexing (ATTM);
Broadband Deployment - Energy Efficiency
and Key Performance Indicators;
Part 2: Network sites;
Sub-part 1: Operator sites**



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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM).

The present document is part 2-1 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.3].

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. It is therefore important to maximize the energy efficiency of all the network elements necessary to deliver the required services.

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.

The present document is part 2-1 of a multi-part deliverable which has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM) in close collaboration with CENELEC via the Co-ordination Group on Installations and Cabling (CGIC). It offers a contribution to the required standardization process by establishing an initial basis for work on ICT networks and transmission engineering, with active collaboration from a number of other ETSI and CENELEC Technical Bodies. When complete, the multi-part deliverable contains information that has been jointly evolved to present developments in installations and transmission implementation, and describing their progress towards energy efficiency in Next Generation Networks (NGN).

In order to monitor the implementation and operation of energy efficient broadband deployment, the present document also discusses Key Performance Indicators (KPI) for energy efficiency and focus on the possible consequences of standardization of installations, cabling techniques and equipment. In particular, the study will investigate possibilities and suggest solutions for development of processes for optimization in installation techniques and energy consumption.

1 Scope

The present document details measures which may be taken to improve the energy efficiency within operator's sites for broadband deployment. Clauses 2 and 3 contain references, definitions and abbreviations which relate to this part; similar information will be included in the corresponding clauses of the other parts, thus ensuring that each document can be used on a "stand-alone" basis.

Within the present document:

- clause 4 introduces operator sites concepts;
- clause 5 details the approaches that may be employed to improve energy efficiency within the areas of the operator site containing network telecommunications equipment;
- clause 6 details the approaches that may be employed to improve energy efficiency within the areas of the operator site containing information telecommunications equipment.

This will enable the proper implementation of services, applications and content on an energy efficient infrastructure, though it is not the goal of this multi-part deliverable to provide detailed standardized solutions for network architecture.

The present document focuses on energy efficiency. The CO_2 footprint is not taken in account in 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 a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - for informative references.

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

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2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

Not applicable.

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

[i.1] ETSI EN 300 019-1-3: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weatherprotected locations".

[i.2] ETSI TR 102 489: "Environmental Engineering (EE); European telecommunications standard for equipment practice; Thermal Management Guidance for equipment and its deployment".

[i.3] ETSI TS 105 174-1: "Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment - Energy Efficiency and Key Performance Indicators; Part 1: Overview, common and generic aspects".

[i.4] ETSI TS 105 174-2-2: "Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment - Energy Efficiency and Key Performance Indicators; Part 2: Network sites; Sub-part 2: Data centres".

3 Definitions and abbreviations

3.1 Definitions

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

data centre: centralized repository for the storage, management, and dissemination of data and information organized around a particular body of knowledge or pertaining to a particular business

energy efficiency: search in existing DC, or for new future DC, of all tracks and actions allowing minimizing energy needs and costs, the key drivers are economic, decreasing the energy bill by increasing the efficiency of all equipment and minimize power loss

information technology equipment: equipment such as computers, servers, mainframes, calculators and all storage devices as arrays, libraries, tape robots together with routers and switches within the local area networks

network telecommunications equipment: equipment providing direct connection to core and/or access networks including switches, DSLAM, BTS

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

3.2 Abbreviations

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

BTS	Base Transceiver Station
CP	Customer Premises
DC	Data Centre
DSLAM	Digital Subscriber Line Access Multiplexer
ICT	Information Communication Technology
KPI	Key Performance Indicator
NGN	Next Generation Network
OS	Operator Site

4 Overview of operator sites

As shown in figure 1, an operator site 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. In turn, operator sites also enable indirect connectivity between customer premises. Operator sites 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.

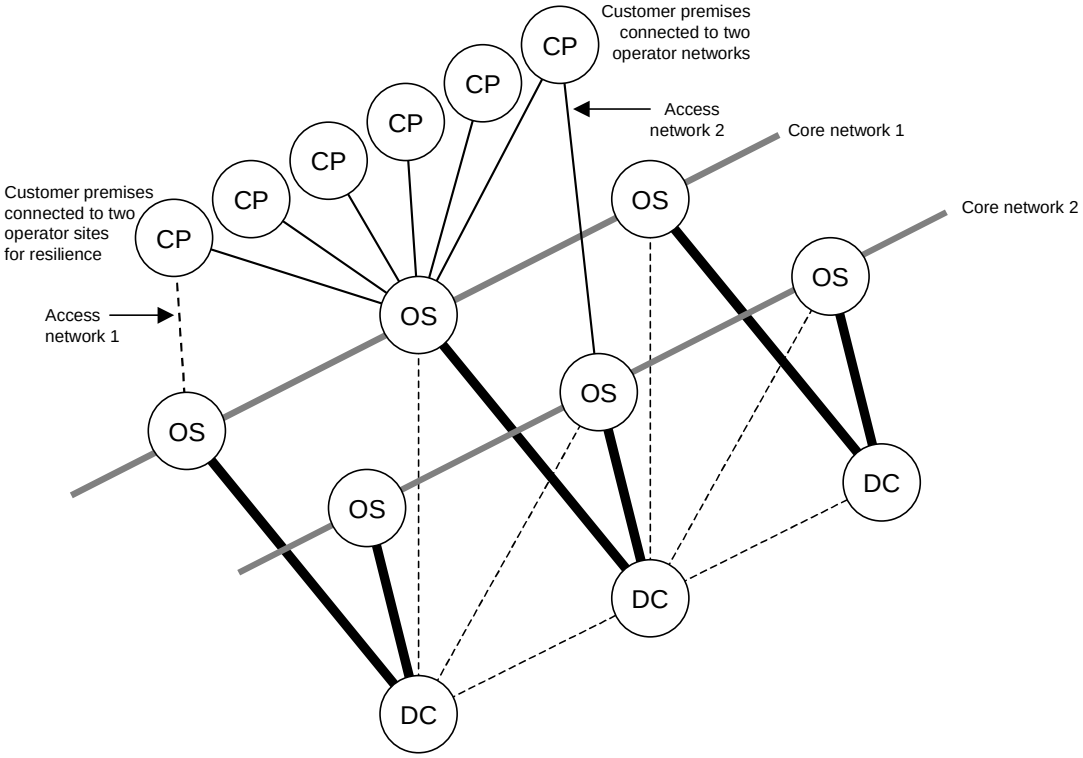

Figure 1: Network sub-systems of broadband deployment

An operator site is designed to accommodate, as a primary function, network telecommunications equipment which provides connections via the core network to other operator sites and network data centres and via the access network to customer premises. The operator site may also accommodate information technology equipment associated with the core and customer network connections. In some cases the operator site may have sufficient information technology equipment to allow it to be considered to be a network data centre as described in TS 105 174-2-2 [i.4] but with augmented network telecommunication connectivity.

Historically, operator sites are typically located in urban areas. These buildings and their infrastructure were designed to accommodate network telecommunications equipment which had a considerable lower power requirements lower than the modern network telecommunications equipment that has replaced it. Network telecommunications equipment has also reduced in terms of physical volume allowing the installation of additional network telecommunications and information technology equipment - often from multiple operators and also in support of multiple access network architectures (such as combined wired and wireless operator sites). The primary power supply to these locations was often not designed for the high levels of energy usage required by the technology now employed.

The process of evolution within operator sites rarely allows complete refurbishment due to the need to maintain service to the access network. Therefore, the opportunity for the significant rebuilding of environmental control or power distribution systems is limited. Hence it is unlikely that the overall energy efficiency of operator sites could ever be made to approach that of purpose-built complexes housing data centres.

As energy costs continue to rise and concerns regarding its availability increase, it will become even more necessary to employ new generation hardware with greater energy efficiency.

The approaches applied to the improvement of energy efficiency that are applied to data centres as described in TS 105 174-2-2 [i.4] are not expected to be equally applicable to operator sites but may be applied effectively to certain areas within the operator site. Clause 5 reviews the applicability of the approaches applied to the areas allocated to network telecommunications equipment. Clause 6 reviews the applicability of the approaches applied to the areas allocated to information technology equipment.

5 Energy efficiency in areas containing network telecommunications equipment

The four principal methods of addressing energy efficiency in network data centres described in TS 105 174-2-2 [i.4] address:

- the information technology infrastructure;
- the environmental control systems;
- the physical infrastructure of the buildings;
- the power distribution system.

Within the areas of operator sites containing network telecommunications equipment, the main routes to improve energy efficiency in the information technology infrastructure relate to programmes of virtualization and consolidation. These are not applicable to the network telecommunications equipment that provides connection the core and access networks since the equipment is designed for a specific purpose in relation to the services provided over the core and access networks. In addition the operational life of network telecommunications equipment tends to be significantly longer than that of information technology equipment.

Within the areas of operator sites containing network telecommunications equipment, the main routes to improve energy efficiency in the environmental control systems relate to:

- the amendment of the ambient temperature within the area - network telecommunications equipment meeting EN 300 019-1-3 [i.1] allows wider environmental ranges to be supported;
- the use of free cooling - there is no opportunity to re-locate operator sites to make use of alternative cooling solutions.

The modification of the physical infrastructure within areas containing network telecommunications equipment in order to maximize the effectiveness of cooling systems has been addressed and any refurbishment of operator sites should take the recommendations of TR 102 489 [i.2] into account.

Within the areas of operator sites containing network telecommunications equipment, the opportunity to make improvements to the power distribution system are limited principally by the typically inflexible requirements of the network telecommunications equipment for 50 V d.c. supply.

For the reasons detailed above, the four principal methods detailed in TS 105 174-2-2 [i.4] are not universally applicable.

6 Energy efficiency in areas containing information technology equipment

The four principal methods of addressing energy efficiency in network data centres described in TS 105 174-2-2 [i.4] address:

- the information technology infrastructure;
- the environmental control systems;
- the physical infrastructure of the buildings;

- the power distribution system.

All of these approaches, with the exception of the restriction of opportunity for free cooling solutions due to the fixed location of the operator site, are directly applicable to areas within the operator site containing information technology equipment. To take advantage of all the approaches it may be more appropriate to locate the information technology equipment within a network data centre and to restrict the operator site to the accommodation of network telecommunications equipment.

The requirements for conformance and the associated recommendations of TS 105 174-2-2 [i.4] are also directly applicable.

History

Document history		
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