SLOVENSKI STANDARD
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Okoljski inženiring (EE) - Standardizacijski izrazi in smernice na področju energetske učinkovitosti

Environmental Engineering (EE) - Standardization terms and trends in energy efficiency

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Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Environmental Engineering (EE).

Modal verbs terminology

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Executive summary

The present document contains high level definition of energy efficiency, energy management requirement to increase the energy efficiency of ICT goods/networks/services.

Introduction

The present document was developed jointly by ETSI TC EE and ITU-T Study Group 5 and published respectively by ITU and ETSI as Recommendation ITU-T L.1315 [i.3] and ETSI Standard ETSI ES 203 475, which are technically equivalent.

1 Scope

The present document specifies terminology, principles and concepts for Energy efficiency and energy management.

The present document establishes common understanding on measurement methodology used to determine the energy efficiency of a good, service and network.

The present document is a framework for other ETSI standards and other Standard Development Organization SDO document for Energy efficiency thematic.

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.

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[i.1] Recommendation ITU-T L.1310 (08/2014): "Energy efficiency metrics and measurement methods for telecommunication equipment".

[i.2] ISO 14040 (07/2006): "Environmental management -- Life cycle assessment -- Principles and framework".

[i.3] Recommendation ITU-T L.1315 (05/2017): "Standardization terms and trends in energy efficiency".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

active mode: For (small) networking equipment, this is the operational mode where all ports (WAN and LAN) are connected, with at least one Wi-Fi connection, if a Wi-Fi function is available. (As defined in Recommendation ITU-T L.1310 [i.1]).

energy: "The capacity for doing work". In the telecommunication systems, where the primary source of energy is electricity, energy is measured in Joules. (As defined in Recommendation ITU-T L.1310 [i.1]).

functional unit: (Based on ISO 14040 [i.2]). A performance representation of the system under analysis. For example, for transport equipment, the functional unit is the amount of Data transmitted, the distance over which it is transported and its rate in Gbit/s. Sometimes the term is used to represent useful output or work. (As defined in Recommendation ITU-T L.1310 [i.1]).

idle mode: For (small) networking equipment, this means the same as active mode, but with no user data traffic (it is not zero traffic, as service and protocol supporting traffic are present) being used, although it is ready to be used (U1 in routers part). (As defined in Recommendation ITU-T L.1310 [i.1]).

low power (sleep) mode: For small networking equipment, this means a state that happens after the device detects no user activity for a certain period of time and reduces energy consumption. For this state, no user-facing LAN ports are connected; the Wi-Fi is active but no clients are connected. The WAN port may be inactive. The device will reactivate on detecting a connection from a user port or device. (As defined in Recommendation ITU-T L.1310 [i.1]).

small networking device: A networking device with fixed hardware configuration, designed for home/domestic or small office use, with less than 12 wired ports. This device can have wireless functionality implemented. (As defined in Recommendation ITU-T L.1310 [i.1]).

3.2 Symbols

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

η	Efficiency

3.3 Abbreviations

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

AC	Alternating Current
CRT	Cathode Ray Tube
EER	Energy Efficiency Rating
EUT	Equipment Under Test
ICT	Information and Communication Technology
LAN	Local Area Network
LCD	Liquid Cristal Display
LED	Light Emitting Diode
PUE	Power Usage Effectiveness (for datacentre)
SDO	Standard Development Organization
WAN	Wide Area Network

4 Energy Efficiency

4.1 General concept

Energy Efficiency is a widely used term with multiple meanings, one can hear "use stairs, be energy efficient" Energy efficient office or house or many others.

Since we are talking about electrical devices, efficiency definition could start from a generic definition for Energy Efficiency for energy converting devices:

$$\eta = Energy_{output} / Energy_{input} \quad (1)$$

"Energy Efficiency" that applies to any device that uses energy to do work: "Percentage of total energy input to a machine or equipment that is consumed in useful work and not wasted as useless heat." This could be expressed as follows:

$$\eta = \frac{Energy\,for\,use\,full\,work}{Total\,used\,energy} \quad (2)$$

By definition, "Energy Efficiency" is always in the range from 0 to 1, or 0 to 100 % (if expressed as a percentage).

The goal of increasing energy efficiency is to realize solutions that will give the same or better functionality using less energy.

For IT equipment output energy does not represent useful output energy therefore, Energy, Energy Efficiency for IT equipment shows how much energy used to perform a Functional Unit (which is specific for the device or solution). EE increase is one of ways of managing and restraining the growth in energy consumption. Devices is more energy efficient if it delivers more services for the same energy input, or the same services for less energy input. For example, when a LED/LCD Display uses less energy than a traditional display based on Cathode Ray Tube (CRT) to reproduce the video, the display is considered to be more energy efficient.

The goal of energy efficiency increase is to provide solutions that will give more functionality using less energy.

Trivial solution for the maximum energy saving can be achieved simply by switching off the device, but that will eliminate the service delivered by the device as well and EE will be zero as a result.

This is the major reason to consider for an equipment the energy efficiency and not only the energy consumption; Energy Efficiency is not an absolute metric, this implies that if it is necessary to do a comparison between equipment it is possible only for equipment of the same type and with similar functionality.

Energy efficiency increase is important at all stages of the energy chain from generation to final consumption. Eventually the benefits of energy efficiency increase will outweigh the costs, for instance those involved in renovations.

Energy efficiency is not equal to energy conservation. Energy conservation is reducing or going without a service to save energy.

The Power Usage Effectiveness (PUE) concept used for data centre follows this formulation.

When the energy efficiency concept it is applied to the ICT world, it is not possible to make reference to output to power or energy and it is important to introduce the concept of a proxy for useful work, changing formula 1.

In this case, the energy efficiency rating of functionality shall be expressed as the ratio between the expected result normally called a proxy for Useful work (similar to Functional Unit) and the energy used to realize the that functionality.

The new formula will be:

$$EER = \frac{useful\,work}{Total\,used\,energy} \quad (3)$$

This formula in this case is not a ratio between two values with same units but between two different characteristics so the indicator of efficiency realized will be not a pure number but a ratio of useful work and energy the measurement unit will be different depending on the useful work selected for the service/EUT e.g. bit/J in the case that the useful work is a throughput, measured in bit/s