



Operational energy Efficiency for Users (OEU); Global KPI for Information and Communication Technology Nodes

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Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) Operational energy Efficiency for Users (OEU).

Introduction

Further to the 1997 Kyoto protocol [i.8], the European Commission has issued, and will issue, Directives in order to improve energy management of broadband networks, sites included, of whole industry sectors.

Therefore suppliers and users of information and communication technology (ICT) equipment are obliged to implement "Green" tools (indicators, recognized Green levels) to monitor the efficiency of their greener networks.

ICT Nodes constitute an important ICT area of energy consumption. Consequently, a target of ETSI ISG OEU has been the development of this Position Paper defining appropriate technical Global Key Performance Indicators (KPIs) to be used for operational Nodes, mainly transmission nodes of ICT users.

The present document has been developed by ISG OEU members (ICT world Users) supported by the CTO Alliance/CRIP in order to define the most efficient tools.

As defined in the Group Specification GS OEU 001 [2] on Global KPIs for Data Centres, the present document takes into account the whole document GS OEU 001 [2] and its definitions of Objective and Global Key Performance Indicators in relation to energy management for operator data centres (ODC), operator sites (OS) and customer data centres (CDC).

1 Scope

The present document defines the current position of the ISG OEU members in relation to the so-called Global Key Performance Indicator (Global KPI) enabling the monitoring of ICT node (DC) energy management.

Following Group Specification GS OEU 001 [2] the present document defines Global Key Performance Indicators in relation to energy management for all kinds of operator sites (OS) (e.g. transmission nodes, central offices) and addresses the following objectives:

- energy consumption;
- task efficiency;
- energy reuse;
- renewable energy.

The present document defines:

- four KPIs addressing these objectives (Objective KPIs);
- one Global KPI which combines the four Objective KPIs.

The Objective and Global KPIs defined here apply to data centres or operator sites of any size from initial operation to end of life.

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 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>.

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2.1 Normative references

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

- [1] CENELEC EN 50600 Series: "Information technology - Data centre facilities and infrastructures".
- [2] ETSI GS OEU 001: "Operational energy Efficiency for Users (OEU); Technical Global KPIs for Data Centres".

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] EC 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".
- [i.2] ETSI ES 205 200-2-1: "Access, Terminals, Transmission and Multiplexing (ATTM); Energy management; Global KPIs; Operational infrastructures; Part 2: Specific requirements; Sub-part 1: Data centres".

- [i.3] ETSI TS 105 174-2-1: "Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment - Energy Efficiency and Key Performance Indicators; Part 2: Network sites; Sub-part 1: Operator sites".
- [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] ETSI TR 105 174-1: "Access, Terminals, Transmission and Multiplexing (ATTM); Broadband Deployment & Energy Efficiency; Part 1: Overview, common and generic aspects".
- [i.8] Kyoto Protocol to the United Nations Framework Convention on Climate Change.
- [i.9] ETSI ES 205 200 Series: "Access, Terminals, Transmission and Multiplexing (ATTM); Energy management; Global KPIs; Operational infrastructures".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

energy consumption: annual energy consumption required for proper operation of the data centre, expressed as KWh, defined as "IT equipment footprint", whatever the power source is (utility or local)

energy consumption per square metre: energy consumption expressed as KWh per sqm of "occupied" IT room

fossil energy: fuel, coal, gas, etc.

global KPI (KPI_{DCEM}): KPI allowing benchmarking the energy efficiency of ICT nodes (data centres included) depending on their gauge

NOTE: This KPI is composed of two values: the energy consumption gauge and the performance of the ICT node for the relevant gauge.

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

renewable energy: solar, wind, hydrothermal, geothermal, etc.

3.2 Symbols

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

DC_G	Data Centre Gauge
DC_P	Data Centre Performance
EC_{DC}	Total of energy consumptions by a data centre over a year
EC_{FEN}	Total of electricity consumptions based on fossil energy
EC_{HE}	Total of energy consumptions by equipment processing data, for purposes of calculating, storing or transporting, over a year
EC_{REN}	Total of energy consumption from renewable sources
EC_{REUSE}	Total of energy consumption from reused energy
EC_{SP}	Consumption of utility electricity
EC_{TH}	Energy consumption for externally-provided thermal energy (either hot or cold)
KPI_{DCEM}	Global KPI for data centre/ICT nodes energy management as data centre is ICT nodes included as data centre
KPI_{EC}	Objective KPI for "Energy Consumption"

KPI_{ECI}	KPI for "Energy consumption per square metre"
KPI_{REN}	Objective KPI for "Renewable Energy"
KPI_{REUSE}	Objective KPI for "Energy Reuse"
KPI_{TE}	Objective KPI for "Task Efficiency"
K_{TH}	Conversion ratio from thermal energy to electricity
W_{CRs}	CRs mitigation ratio; ranges from 0 to 1
W_{REN}	Mitigation factor for KPI_{REN}
W_{REUSE}	Mitigation factor for KPI_{REUSE}

3.3 Abbreviations

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

CDC	Customer Data Centre
DC	Data Centre
EC DG JRC	European Commission Directorate General Joint Research Centre
GWh	Giga Watt Hour
ICT	Information and Communication(s) Technology
IT	Information Technology
ITE	IT Equipment
KPI	Key Performance Indicator
NTE	Network Telecommunications Equipment
ODC	Operator Data Centre
OS	Operator Site

4 Definition of Key Performance Indicators

4.1 Generalities

The present document applies the requirements of GS OEU 001 [2] and takes into account definitions of the four Objectives KPIs and the Global KPI for data centres.

The Objective KPIs of the ES 205 200-2-1 [i.2] in a simple format and uses them to define a Global KPI which indicates ICT node energy usage and efficiency. It is expected that the present document will influence the development and maintenance of the ES 205 200 Series [i.9] under the responsibility of ETSI ATTM.

Several standards or technical documents have been taken into account during the development of the present document including EC Mandate M/462 [i.1], ES 205 200-2-1 [i.2], TR 105 174-1 [i.7], TS 105 174-2-1 [i.3], the CENELEC EN 50600 Series [1], Recommendation ITU-T L.1300 [i.5], and EC DG JRC Code of Conduct for Data Centres [i.4] and [i.6].

4.2 Objective KPIs for ICT node operation

4.2.1 Energy Consumption (KPI_{EC})

GS OEU 001 [2], clause 4.1.1 has to be taken into account.

4.2.2 Task efficiency (KPI_{TE})

GS OEU 001 [2], clause 4.1.2 has to be taken into account.

4.2.3 Energy reuse (KPI_{REUSE})

GS OEU 001 [2], clause 4.1.3 has to be taken into account.

4.2.4 Use of renewable energy (KPI_{REN})

GS OEU 001 [2], clause 4.1.4 has to be taken into account.

4.3 Global KPI (KPI_{DCEM}) using the Objective KPIs

4.3.1 Introduction

The set of Objective KPIs defined in clause 4.2 are used to define a Global KPI (KPI_{DCEM}) that allows benchmarking the energy efficiency of ICT nodes depending on their gauge.

KPI_{DCEM} is composed of two values, DC_G and DC_P , where:

- DC_G defines the energy consumption gauge of the DC;
- DC_P defines the performance of the DC for the relevant gauge.

4.3.2 Definition of energy consumption gauge of the DC (DC_G)

The default number of DC_G gauges is 4 as shown in table 1 can be adapted by the user of the KPI_{DCEM} .

Table 1: Default Gauges (DC_G)

DC_G	KPI_{EC} range
S	$KPI_{EC} \leq 1$ GWh
M	$1 \text{ GWh} < KPI_{EC} \leq 4$ GWh
L	$4 \text{ GWh} < KPI_{EC} \leq 20$ GWh
XL	$KPI_{EC} > 20$ GWh

4.3.3 Definition of performance of the DC (DC_P)

The calculation of DC_P is addressed below the table 2. Default classes are as shown in table 2.

Table 2: Default Classes of DC_P

DC commissioning date	since 2005 (see note)		before 2005 (see note)	
	DC_P		DC_P	
Class	\geq	$<$	\geq	$<$
A		0,70		1,00
B	0,70	1,00	1,00	1,40
C	1,00	1,30	1,40	1,70
D	1,30	1,50	1,70	1,90
E	1,50	1,70	1,90	2,10
F	1,70	1,90	2,10	2,30
G	1,90	2,10	2,30	2,50
H	2,10	2,40	2,50	2,70
I	2,40		2,70	

NOTE: Year of Kyoto Protocol entering into force.

The following formula applies to the calculation of DC_P for all the gauges:

$$DC_P = KPI_{TE} \times (1 - W_{REUSE} \times KPI_{REUSE}) \times (1 - W_{REN} \times KPI_{REN})$$

where:

W_{REUSE} = Mitigation factor for KPI_{REUSE} (the value may vary depending on the gauge (ffs) within the range 0 to 1, the default value is 0,5).

$W_{REN} =$ Mitigation factor for KPI_{REN} (the value may vary depending on the gauge (ffs) within the range 0 to 1, the default value is 0,5).

4.3.4 Scale

KPI_{DCEM} applies to all data centres of all sizes and includes IT rooms located in buildings.

4.3.5 Evolution

KPI_{DCEM} applies to all states of ICT nodes, from initial operation to end of life.

4.3.6 Matrix for KPI_{DCEM}

The Global KPI_{DCEM} is presented as a combination of the two values, DC_G and DC_P , in the following form: Gauge (see table 1), Class (see table 2) e.g. M, E.

4.3.7 Measurement points and processes

According to methodology defined in clause 4.1.

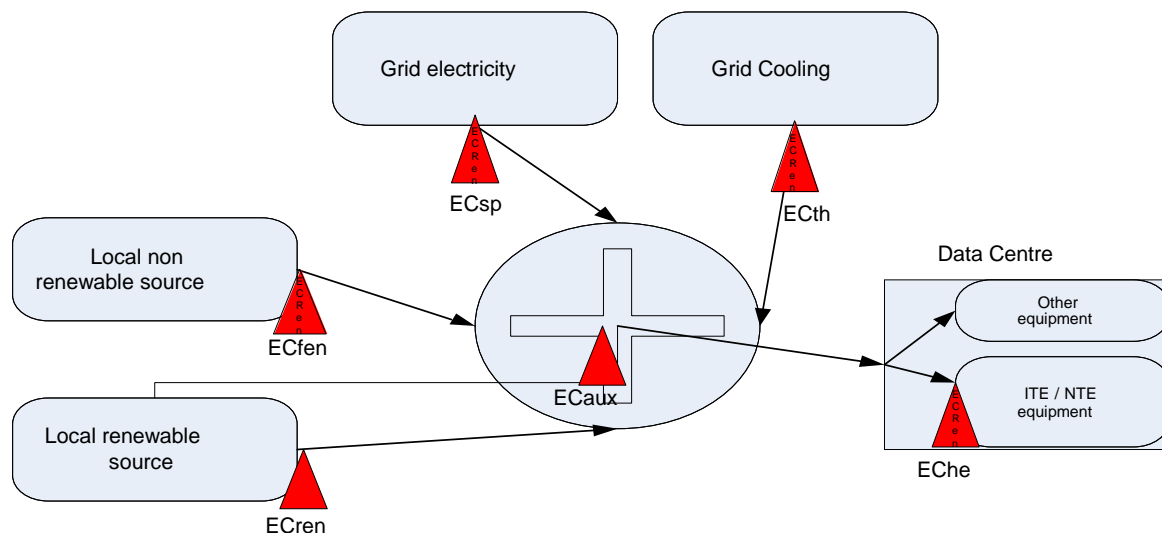


Figure 1: Energy measurement points

Annex A (informative): Energy Consumption per square metre (KPI_{EC1})

A.1 Generalities

KPI_{EC1} is calculated from KPI_{EC} and takes into account the IT room floor space.

A.2 Scale

KPI_{EC1} applies to all ICT nodes of all sizes and includes IT rooms located in buildings.

A.3 Evolution

KPI_{EC1} applies to all states of ICT nodes, from initial operation to end of life.

A.4 Formula

$$KPI_{EC1} = \left(\frac{KPI_{EC}}{(1 + W_{CRs}) \times (CRs - 1)} \right)$$

where:

- CRs = IT room floor space used (by racks, networking, disk arrays and tape robots) = raw footprint of IT and Telco equipment).
- W_{CRs} = CRs mitigation ratio; ranges from 0 to 1.

A.5 Measurement points and procedures

See clause 4.1.1.4 of GS OEU 001 [2].

Annex B (informative): The status of Key Performance Indicators (KPIs)

See annex B of GS OEU 001 [2].

Annex C (informative): Bibliography

- CEN EN 1434 Series: "Heat meters".
- Directive 2010/31/EU of the european parliament and of the council of 19 May 2010 on the energy performance of buildings.

History

Document history		
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