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Information technology — Data centres key performance indicators —

Part 9: Water usage effectiveness (WUE)

Technologies de l'information — Indicateurs de performance clés des centres de données —

Partie 9: Efficacité dans l'utilisation de l'eau (WUE)

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Contents

Page

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 39, *Sustainability, IT and data centres*.

A list of all parts in the ISO/IEC 30134 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

Introduction

The global economy is today reliant on information and communication technologies and the associated generation, transmission, dissemination, computation and storage of digital data. All markets have experienced exponential growth in that data, for social, educational and business sectors and while the internet backbone carries the traffic, there are a wide variety of data centres at nodes and hubs within both private enterprise and shared/collocation facilities.

The historical data generation growth rate exceeds the capacity growth rate of information and communications technology hardware. In addition, with many governments having "digital agendas" to provide both citizens and businesses with ever-faster broadband access, the very increase in network speed and capacity will, by itself, generate ever more usage (Jevons Paradox). Data generation and the consequential increase in data processing and storage are directly linked to increasing power consumption.

With this background, data centre growth, and power consumption in particular, is an inevitable consequence; this growth will demand increasing power consumption despite the most stringent energy efficiency strategies. This makes the need for key performance indicators (KPIs) that cover the effective use of resources (including but not limited to energy and water) and the reduction of CO_2 emissions essential.

Within the ISO/IEC 30134 series, the term "resource usage effectiveness" is more generally used for KPIs in preference to "resource usage efficiency", which is restricted to situations where the input and output parameters used to define the KPI have the same units.

Water usage effectiveness (WUE) is intended to support data centre practitioners in obtaining an in depth understanding of the performance of the data centre's cooling installation in comparison with similar systems, thereby creating a tool for improvning the sustainability of the data centre. The impact of operational water usage is emerging as being extremely important in the design, location and operation of current and future data centres.

In order to determine the overall resource efficiency of a data centre, a holistic suite of metrics is required. This document is one of a series of International Standards for such KPIs and has been produced in accordance with ISO/IEC 30134-1, which defines common requirements for a holistic suite of KPIs for data centre resource efficiency. This document does not specify limits or targets for the KPI and does not describe or imply, unless specifically stated, any form of aggregation of this KPI into a combination with other KPIs for data centre resource efficiency. This document presents specific rules on WUE's use, along with its theoretical and mathematical development. This document concludes with several examples of site concepts that could employ the WUE metric.

Information technology — Data centres key performance indicators —

Part 9: Water usage effectiveness (WUE)

1 Scope

This document specifies water usage effectiveness (WUE) as a key performance indicator (KPI) for quantifying the water consumption of a data centre during the use phase of the data centre life cycle.

WUE is a simple method for reporting the water intensity of the data centre operating. By reporting water consumption, it is possible to present the data centre's resource effectiveness.

This document:

a) defines the WUE of a data centre;

b) introduces WUE measurement categories;

c) describes the relationship of this KPI to a data centre's infrastructure, information technology equipment and information technology operations;

d) defines the measurement, the calculation and the reporting of the parameter; and

e) provides information on the correct interpretation of the WUE.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 30134-1, *Information technology — Data centres — Key performance indicators — Part 1: Overview and general requirements*

ISO 8601-1, *Date and time — Representations for information interchange — Part 1: Basic rules*

3 Terms, definitions, abbreviated terms and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 30134-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
total data centre energy consumption
total annual energy consumption for all energy types serving the data centre at its boundary

Note 1 to entry: The total data centre energy is measured in MWh; the energy is measured with energy metering devices at the boundary of the data centre or points of generation within the boundary.

Note 2 to entry: This includes electricity, natural gas, hydrogen, bioethanol and district utilities such as supplied chilled water or condenser water.

Note 3 to entry: Total annual energy includes supporting infrastructure.

[SOURCE: ISO/IEC 30134-2:2016, 3.1.7, modified.]

3.1.2
IT equipment energy consumption
energy consumed by equipment that is used to manage, process, store or route data within the compute space

Note 1 to entry: IT equipment energy consumption is measured in MWh; examples for IT equipment are servers, storage equipment, and telecommunications equipment.

Note 2 to entry: IT equipment energy use follows the same categories as in ISO 30134-2 Power usage effectiveness.

[SOURCE: ISO/IEC 30134-2:2016, 3.1.1, modified.]

3.1.3
water usage effectiveness
ratio of the data centre water consumption divided by the energy consumed by IT equipment

3.1.4
water use
water that is used by end-users for a specific purpose within a given territory

Note 1 to entry: For the purposes of this document, water use corresponds to the water consumption caused by the processing of data in a data centre.

Note 2 to entry: Domestic use, irrigation or industrial processing are examples of a given territory.

Note 3 to entry: Water use is measured in water volume (m^3) consumed.

3.1.5
reused water
water that is leaving the data centre boundaries for an alternative non-data-centre use

Note 1 to entry: The non-data-centre use of water is usually defined by local regulations for reuse.

3.1.6
potable water
water that is free from contamination and that is safe to drink or to use for food and beverage preparation and personal hygiene

Note 1 to entry: Potable water is also known as drinking water.

Note 2 to entry: The definition of the quality criteria of potable water is usually subject to national or local regulations; if there is no information about the criteria see Reference [2].

3.1.7
energy water intensity factor
amount of water that is used to produce energy

Note 1 to entry: Energy water intensity factor is measured in m^3 per MWh.

3.1.8
water significance
amount of renewable freshwater that is available for each person each year

Note 1 to entry: Within the approach of this document, water significance is categorized by different levels of water stress.

3.1.9
water stress
ability to meet human and ecological demand for freshwater

3.1.10
water quality
physical, chemical and biological characteristics of water concerning its suitability for an intended use by humans, ecosystems or industrial processes

3.1.11
land consumption
loss of water permeability of the soil intended for use by humans, ecosystems or industrial processes

3.2 Abbreviated terms

For the purposes of this document, the abbreviated terms in ISO/IEC 30134-1 and the following apply.

DC	data centre
dWUE	design water usage effectiveness
EWIF	energy water intensity factor
FI	falkenmark indicator
iWUE	interim water usage effectiveness
peakWUE	peak water usage effectiveness
PUE	power usage effectiveness
pWUE	partial water usage effectiveness
qWUE	quality water usage effectiveness
WRF	water reuse factor
WUE	water usage effectiveness

3.3 Symbols

For the purposes of this document the following symbols apply:

E_{DC}	total data centre energy consumption (annual) in MWh
E_{IT}	IT equipment energy consumption (annual) in MWh
f_{EWI}	energy water intensity factor (EWIF)
$f_{r,w}$	water reuse factor (WRF)
$f_{s(F)}$	drainage factor of fully sealed surfaces

$f_{s(f)}$ drainage factor of few sealed surfaces

$f_{s(h)}$ drainage factor of heavily sealed surfaces

I_w total water input from outside the data centre boundaries (annual) measured by total volume in m^3

$I_{w,e}$ water input from water consumption of energy production

$I_{w,p}$ water input from potable water

$I_{w,rw}$ water input from rainwater

i_F falkenmark indicator (FI)

L_{DC} data centre land consumption

O_w total water returned out of the data centre boundaries (annual) measured by total volume in m^3

p population

s_F fully sealed surface

s_f few sealed surfaces

s_h heavily sealed surfaces

s_{run} surface runoff (annual) measured in m^3

U_w water usage of the data centre (annual) measured by total volume in m^3

$U_{r,w}$ water reusage of the data centre (annual) measured by total volume in m^3

$U_{r,w,I}$ industrial water reuse

$U_{r,w,NI}$ non-industrial water reuse

$\eta_{U,W}$ water usage effectiveness

$\eta_{U,W,i}$ interim water usage effectiveness

NOTE Unlike for PUE, the unit of the energy used in WUE is MWh.

4 Applicable area of the data centre

WUE as specified in this document:

— is associated with the data centre infrastructure and IT equipment within its boundaries only;

— describes the water usage in relation to facilities with given environmental conditions, IT load characteristics, availability requirements, maintenance and security requirements;

— measures the relationship between the total data centre water usage and the IT equipment energy consumed.

WUE does not:

— account for efficiency of other resources such as human resources, space or CO_2;

— provide a data centre productivity metric;

— provide a standalone, comprehensive efficiency metric;

— account for quality of the water reuse process outside the data centre boundaries;

— account for water down- or upgrade (reducing or improving water quality).

5 Determination of WUE

WUE provides a way to determine the water usage associated with data centres. A value of 0,0 indicates that no water use is associated with the data centre's operations. WUE has no theoretical upper and no theoretical lower boundary.

WUE is defined according to Formula (1):

$$\eta_{U,W} = \frac{U_w}{E_{IT}} \tag{1}$$

Annual water usage is calculated according to Formula (2) as:

$$U_w = I_w - O_w \tag{2}$$

WUE may be applied in mixed-use buildings when measurement of the difference between water used for the data centre and that for other functions is possible.

6 Measurement of WUE

6.1 General

All KPIs of the ISO/IEC 30134 series are defined within the boundaries of a data centre (see ISO/IEC 30134-1).

6.2 Measuring actual water usage

6.2.1 Calculation, measurement period and frequency

The minimum calculation and measurement period requires twelve months of cumulative energy and water values. Annualized data used to calculate WUE shall be documented. The annual energy values for energy consumption of the IT equipment collected shall cover the same time period. It is not necessary to define the frequency of measurement or assessments for the annual WUE determination, as the annual water value is a continuous integration of energy consumed in that timeframe. Examples of the calculation are shown in the Annex A.

NOTE The measurement or assessment frequency can be necessary for subsystem improvements (refer to partial PUE), but is not required for WUE disclosures.

6.2.2 Categories of WUE

6.2.2.1 Introduction

The categories of WUE are defined, as shown in Table 1, to provide a defined route to refine the accuracy of the WUE measured. WUE considers different water qualities and types of reused water. Category 3 requires additional reporting for regional water significance (level of water stress, in accordance with Annex B) and land consumption (in accordance with Annex D).

Table 1 — WUE categories

Source	Category 1 (WUE_1) basic	Category 2 (WUE_2) intermediate	Category 3 (WUE_3) advanced
Considered water input	Physical water input of the DC.	Physical water input of the DC.	Water consumption of energy production and physical water input excluding rainwater.
Considered water output	No water reuse; water input equates to water use.	Water output of the DC for non-industrial reuse.	Water output of the DC with measurement of non-industrial and industrial reuse.
Additional reporting	No.	No.	Regional water stress level and land consumption.

The water qualities for the water input are differentiated into potable and non-potable water. If there exists a regional definition of water qualities for potable and non-potable, this shall be taken into account. Otherwise definitions given in this document shall be applied. For water output, a distinction is made between two typs of reused water: non-industrial reuse and industrial reuse. The definition of the criteria for water reuse is usually subject to national or local regulation. The part of the water output that is not reused is specified as used water.

6.2.2.2 WUE category 1: water usage without reuse

WUE_1 is a metric considering total water consumption of the data centre. For the water output there is no distinction of water use and water reuse in category 1 (see Figure 1). For WUE_1 the significance of regional water shortage and land consumption is not considered.

NOTE For the water input, potable water and non-potable water are considered.

WUE_1 includes the water used at the DC location for operation of the data centre. This contains water used for humidification and water evaporated on site for energy production or cooling of the data centre and its support systems.

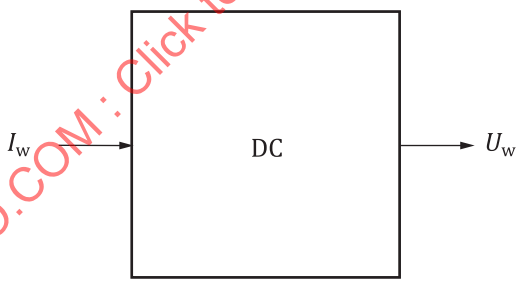

Figure 1 — WUE category 1

The WUE for category 1 is calculated using Formula (3):

$$\eta_{U,W,1} = \frac{U_w}{E_{IT}} \tag{3}$$

For category 1, I_w is equal to U_w. For the water output in category 1 there is no reuse of water considered. This means that all the water that goes into the DC is leaving the DC as used water. WUE_1 requires only basic measurements for the water input. Measurements for the water output are not necessary. For WUE_1 an additional reporting of regional water stress level and land consumption is not necessary.

6.2.2.3 WUE category 2: water usage including reuse

WUE_2 is a metric considering total water consumption of the data centre. For the water output there is a distinction of water use and water reuse in category 2 (see Figure 2). For category 2, the reuse of

water refers exclusively to non-industrial water. For WUE_2 an additional reporting of regional water stress level and land consumption is not necessary.

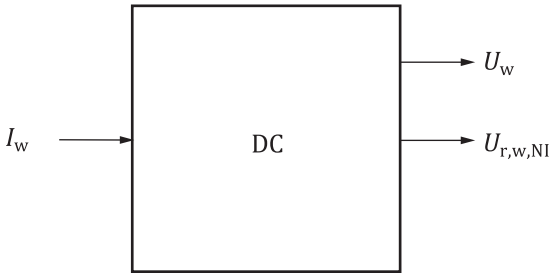

Figure 2 — WUE category 2

The WUE for category 2 is calculated using Formula (4):

$$\eta_{U,W,2} = \frac{U_w}{E_{IT}} \tag{4}$$

where $U_w = I_w - U_{r,w,I}$

WUE_2 requires only basic measurements for the water input. The non-industrial water reuse shall be measured. For WUE_2 an additional reporting of regional water stress level and land consumption is not necessary.

6.2.2.4 WUE category 3: water usage including energy and industrial reuse

WUE_3 is a metric considering total water consumption of the data centre. For category 3, the water input excluding used rainwater for DC operations shall be determined. In addition, water consumption of energy production that is used by the data centre shall be determined (see Figure 3).

NOTE 1 By excluding rainwater from the water input, benefits for the use of collected water from rain are considered. Used rainwater is part of the non-potable water input.

To determine the water consumption of energy production that is used by the data centre, the total energy consumption of the data centre needs to be known. This value shall then be combined with an EWIF (see Annex C) that is based on the water used to produce the energy. The data for the EWIF shall be provided by the energy provider/producer.

If the actual energy water intensity values are not available from the local energy supplier, WUE calculations are limited to the WUE_1 and WUE_2 methods. The EWIF values in Table C.1 are examples and shall not be used in the absence of actual values from the local energy supplier.

NOTE 2 For used water in the delivery of the energy (e.g. electricity, heat, cold, natural gas, diesel fuel) there is no physical water input at the data centre boundary. Water input for energy is always "used“ because electricity is "lost“ (converted into heat).

For the water output there is a distinction of water use and water reuse in category 3. For category 3, the reuse of water refers to non-industrial water and industrial water.

The reporting WUE_3 considers the significance of regional water shortage and land consumption.

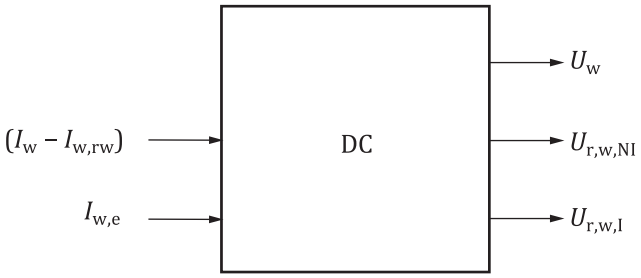

Figure 3 — WUE category 3

The WUE for category 3 is calculated using Formula (4):

$$\eta_{U,W,3} = \frac{U_w}{E_{IT}} \tag{5}$$

where $U_w = (I_w - I_{w,rw} + I_{w,e}) - (U_{r,w,I} + U_{r,w,IN})$

and where $I_{w,e} = E_{DC} \times f_{EWI}$

7 Application of WUE

WUE can be used by data centre managers to monitor and report water consumption related to IT energy consumption in the data centre.

This KPI can be used independently, but to obtain a more holistic picture of the resource effectiveness of the data centre, other KPIs of the ISO/IEC 30134 series should be considered. Where WUE is reported, the corresponding PUE value should also be reported.

In many regions of the world, water shortage is a serious problem. Water stress causes deterioration of freshwater resources in terms of quantity and quality. Water stress as a result of consumption is caused by the extensive use of water in industry and agriculture/livestock breeding. A large part of this is indirect use in water-intensive industrial processes including data centres. For that reason, category 3 considers different stages of water significance.

The expansion of built-up areas reduces open space in and around cities, impacting ecosystem services like water circulation. Important soil functions, especially water permeability, are lost. The DC-related built-up areas are part of this land consumption. For that reason category 3 considers DC land consumption.

Planning, building and operating a DC should consider the impact on water quality, water significance and land consumption. For selection of a DC site, regional water significance, water reuse potential and the expansion of built-up areas are important factors.

8 Reporting of WUE

8.1 Requirements

8.1.1 Standard construct for communicating WUE data

For a reported WUE to be meaningful, the reporting organization shall provide the following information:

a) the DC under inspection,

b) the WUE value,

c) the WUE category,

d) the water-significance for WUE_3,

e) the land consumption for WUE_3,

f) the termination date of the period of measurement using the format of ISO 8601-1 (e.g. yyyy-mm-dd).

The WUE category shall be provided as a subscript to the name of the metric, e.g. WUE_2 for a category 2 value.

8.1.2 Data for public reporting of WUE

8.1.2.1 Required information

The following data shall be provided when publicly reporting WUE data:

a) contact information (at least organization's name);

b) data centre location information (at least county or region);

c) measurement results: WUE with appropriate nomenclature;

d) specification of the water volume measuring end points and devices in terms of calibration;

e) information for regional water usage of the energy provider (EWIF).

8.1.2.2 Supporting evidence

Information on the DC which shall be available upon request as a minimum includes:

a) organization's name, contact information and regional environmental description;

b) measurement results: WUE with appropriate nomenclature;

c) E_{IT} and U_w;

d) measurement(s) start dates and assessment completion dates;

e) report on the size of the size of the DC building;

f) external environmental conditions consisting of minimum, maximum and average temperature, humidity and altitude;

g) corresponding PUE value and category;

h) energy sources and conversion factors (e.g. EWIF) reference.

8.2 Recommendations

The following information can be useful in tracking the WUE trends within a DC:

a) DC size (facility m^2);

b) total DC design load for the facility (e.g. 10 MW);

c) name of the possible auditor and method used for auditing;

d) DC contact information;

e) DC environmental conditions;

f) DC location and region;

g) DC's mission;

h) DC archetype percentages (e.g. 20 % web hosting, 80 % email);

i) DC commissioned date;

j) numbers of servers, routers, and storage devices;

k) average and peak server CPU utilization;

l) percentage of servers using virtualization;

m) average age of IT equipment by type;

n) average age of facility equipment by type (cooling and power distribution equipment);

o) DC availability objectives (see ISO/IEC 30134-1:2015, Annex A);

p) cooling and air-handling details.

NOTE Other KPIs within the ISO/IEC 30134 series can assist in the recording of the above information.

8.3 Example of reporting WUE values

Using the construct of 8.1.1, this subclause provides examples of specific WUE designations and their interpretations.

EXAMPLE 1

Sample WUE designations for category 1:

DC X: WUE_1 (2020-12-31) = 3,0

Interpretation:

In the year 2020 the WUE value of DC was 3,0, i.e. 6,00 m^3 water were used for 2 MWh of IT energy within the DC. It was a category 1 WUE.

EXAMPLE 2

Sample WUE designations for category 3:

DC Y: WUE_3 (2020-12-31) = 4,0; no water stress; land consumption of 10 000 m^2

Interpretation:

In the year 2020 the WUE value of DC Y was 4,0, i.e. 4,00 m^3 water were used for 1 MWh of IT energy within the DC. DC location with no water stress and 10 000 m^2 land consumption by sealed areas of a DC property. It was a category 3 WUE.

8.4 WUE derivatives

8.4.1 Purpose of WUE derivatives

Often, WUE values are needed:

a) to indicate WUE for periods less than 12 months; and/or

b) to provide the WUE for separated, non-standalone data centres (i.e. mixed building); and/or

c) to predict a desired WUE value during the design stage of the data centre; and/or

d) to provide the WUE for single water qualities; and/or

e) to provide the WUE for water reuse;

f) to indicate WUE value for the maximum water demand.

For this purpose, WUE derivatives and the water reuse factor are introduced in 8.4.3 to 8.4.6 and 8.5, which address these specific needs. Each derivative shall be accompanied with specific information that describes the specific situation.

The use of WUE derivatives shall be documented as described in the subclauses 8.4.3 to 8.4.6. Combined use of the terms is permitted to describe specific situations and values. An example use of these derivatives is:

design, interim pWUE (20xx-08-01:20xx-08-31) = 3,1 [ref. jjj]

[jjj]: [boundaries of the DC, shared cooling, space, physical security]

40 % IT load, environmental conditions, etc.

8.4.2 Interim WUE

The definition of WUE clearly indicates that it is an annual figure. In cases where a need to report the WUE for other periods of time exists, for example for water billing reasons, WUE may also be reported for other time periods with a prefix "i" and the time period in the subscript, e.g. $iWUE_{yyyy\text{-}mm\text{-}dd\ –\ yyyy\text{-}mm\text{-}dd}$.

It should be noted, however, that a period of WUE reporting with less than twelve-month measurements can affected by the variables such as outdoor temperatures and can not be comparable with other periodical values of WUE. The time periods shall be consistent with the reporting of iPUE or other interim KPIs. iWUE shall describe a WUE measured for a period of less than a year.

In addition to 8.1.1 the reporting of iWUE shall include the start date of the period of measurement using the format of ISO 8601-1.

8.4.3 Partial WUE

In addition to 8.1.1, the reporting of partial WUE (pWUE) should include an explicit list of shared resources.

8.4.4 Design WUE

Design WUE (dWUE) shall describe a predicted WUE for a DC prior to its operation.

In addition to 8.1.1, the reporting of dWUE should include a schedule of dWUE and dPUE based on target IT loads.

8.4.5 Quality WUE

The definition of WUE clearly indicates that all water qualities are included. Usually there are no separated measurements for certain water qualities in a DC. In cases where a need to report the WUE for a certain water quality exists, for example for water billing reasons, WUE can be reported for a single water quality with the prefix "q". qWUE shall only be applied if water input and water output for this specific water quality can be measured separately from other water qualities, e.g. standalone water system for rainwater usage. qWUE does not include water downgrade or water upgrade.

NOTE Water downgrade describes the reduction of water quality; water upgrade describes the improvement of water quality.

In addition to 8.1.1, the reporting of qWUE shall include the water quality under assessment.

8.4.6 Peak WUE

Peak WUE ($_{peak}$WUE) shall describe a WUE during maximum design conditions (e.g. adiabatic cooling in summer) during an hour of full IT load. Using $_{peak}$WUE can create a distinction between the 'design' and the 'actual' value of WUE.

8.5 Water reuse factor (WRF)

If there is any reuse of water, WUE_2 and WUE_3 shall be reported together with an additional KPI for water reuse. The WRF provides a way to determine the water reusage associated with DCs.

WRF will range from 0 to 1 ($0 \leq WRF \leq 1$). WRF has an ideal value of 1,0, indicating that all water associated with the DC's operations is reused.

The WRF is defined calculated using Formula (6):

$$f_{r,w} = \frac{U_{r,w}}{I_w} \tag{6}$$

Annex A
(informative)

Examples of use

A.1 Correct use of WUE

Annex A provides examples for the correct use and calculation of the WUE to assist in the rapid adoption of WUE through widespread understanding. These examples are all based on the same DC specifications:

The DC availability is class 3, according to ISO/IEC 22237-1. The annual IT electricity consumption, $E_{IT,}$ is 700 000 kWh. The annual data centre electricity consumption, E_{DC}, is 900 000 kWh. The PUE_1 (2016-12-31) of the DC is 1,3.

The DC cooling system uses adiabatic coolers with an annual water demand of 2 000 m^3. The DC electricity comes from natural gas with an EWIF of 3,0 m^3 per MWh. There is no water reuse (e.g. from rainwater).

A.2 WUE category 1

$$\eta_{U,W,1} = U_w / E_{IT} = (2\,000\ m^3/a) / (700\ MWh/a) = 2{,}9\ m^3/MWh$$

where

$U_w = I_w = I_{w,p}$ = 2 000 m^3/a = water demand from the adiabatic cooler

NOTE The part of a unit "/a" means that the measurement period is twelve-month (rolling, per anno). The unit "m^3" or "MWh" means that one cubic metre water is used in the twelve-month measurement period.

A.3 WUE category 3

$$\eta_{U,W,3} = U_w / E_{IT} = (3\,000\ m^3/a) / (700\ MWh/a) = 4{,}3\ m^3/MWh$$

where

$U_w = I_w - O_w = (I_w - I_{w,rw} + I_{w,e}) - (U_{r,w,I} + U_{r,w,NI}) = (2\,000\ m^3/a - 700\ m^3 + 2\,700\ m^3/a) - (0 + 1\,000\ m^3/a) = 4\,000\ m^3/a - 1\,000\ m^3/a = 3\,000\ m^3/a$

where

I_w has a value of 2 000 m^3 water demand from the adiabatic cooler;

$I_{w,e} = E_{DC} \times f_{EWI}$ = 900 MWh × 3,0 m^3/MWh = 2 700 m^3;

for $U_{r,w,I}$, there is no industrial water reuse; and

$U_{r,w,NI}$ has the value of 1 000 m^3/a.

A.4 interim WUE category 3

In summer there is more cooling demand than in winter. As a result there is an increased electricity and water demand for the DC in the period from 2016-07-01 to 2016-07-31. The IT energy demand is 60 MWh in the considered period. The $iPUE_{01.07.2016 - 31.07.2016}$ is 1,7 because of free cooling is not available in summer. The water demand from the adiabatic cooler is 500 m^3 for the considered period.

$$\eta_{U,W,I,2(2016\text{-}07\text{-}01 - 2016\text{-}07\text{-}31)} = U_w / E_{IT} = (500 + 300)\ m^3 / 60\ MWh = 13,3$$

where

$I_{w,e} = E_{DC} \times f_{EWI} = E_{IT} \times \eta_{U,P,I} \times f_{EWI} = 60\ MWh \times 1,7 \times 3,0\ m^3/MWh = 306\ m^3$

The reporting of iWUE shall be: $iWUE_{3(2016\text{-}07\text{-}01 - 2016\text{-}07\text{-}31)} = 13,3$ with $iPUE_{2016\text{-}07\text{-}01 - 2016\text{-}07\text{-}31} = 1,7$.