BLUE ANGEL

The German Ecolabel

Climate-Friendly Colocation Data Centers

DE-UZ 214

Basic Award Criteria

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Version 3

The Environmental Label is supported by the following four institutions:

Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety is the owner of the label. It regularly provides information on the decisions taken by the Environmental Label Jury.

Umwelt Bundesamt

The German Environmental Agency with its specialist department for "Ecodesign, Eco-Labelling and Environmentally friendly Procurement" acts as office of the Environmental Label Jury and develops the technical criteria of the Basic Criteria for Award of the Blue Angel.

Jury Umweltzeichen

The Environmental Label Jury is the independent, decision-making body for the Blue Angel and includes representatives from environmental and consumer associations, trade unions, industry, the trade, crafts, local authorities, academia, the media, churches, young people and the German federal states.

RAL gGmbH

The RAL gGmbH is the awarding body for the Environmental Label. It organises the process for developing the relevant award criteria in independent expert hearings – which involve all relevant interest groups.

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This document is a translation of a German original. In case of dispute, the original document should be taken as authoritative.

1 Introduction

1.1 Preface

In cooperation with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, the German Environmental Agency and considering the results of the expert hearings conducted by RAL gGmbH, the Environmental Label Jury has set up these Basic Criteria for the Award of the Environmental Label. RAL gGmbH has been tasked with awarding the Environmental Label.

Upon application to RAL gGmbH and on the basis of a Contract on the Use of the Environmental Label to be concluded with RAL gGmbH, the permission to use the Environmental Label may be granted to all products, provided that they comply with the requirements as specified hereinafter.

The product must comply with all the legal requirements in the country in which it is to be marketed. The applicant shall declare that the product meets this requirement.

1.2 Background

Due to the increasingly prevalent use of information technology in all areas of business and life, the demand for data centers in Germany will continue to increase in the future. In private households, the use of information technology (e.g. smartphones, computers, Internet-capable television sets, smart home devices) and digital services (e.g. voice-over-IP telephony, video streaming, cloud storage, Internet) is now taken for granted. In the commercial and industrial sector, the use of digital technologies (for accounting, transactions, simulation, computer-aided design and production, logistics, artificial intelligence, etc.) has become an integral part of future-oriented management. Strong growth in the transmission and processing of data in real time is expected due to mobility solutions (autonomous vehicles) and the increasing use of sensors (Internet-of-Things). The processing of this digital data is only carried out to a small extent locally, meaning at the location where it is generated. The data is usually transferred via the Internet and then processed and stored in central data centers. As a result of business models that provide software and services in the cloud, computing power and also energy consumption will be increasingly transferred to data centers in the future.

A study carried out on behalf of the German Federal Ministry for Economic Affairs and Energy (BMWi)[1] forecasts that data centers will account for around 7 percent of the electricity consumption in Germany in 2025 (16.4 terrawatt hours). In terms of the building infrastructure, it is anticipated that the floor space occupied by data centers will increase from 1.5 million square meters in 2010 to around 2.3 million square meters in 2020.[2] This amounts to annual growth in the floor area of 4.4 percent. The expansion in the floor space occupied by data centers will primarily be due to new colocation data centers. It is anticipated that the floor space occupied by these types of data centers will almost triple from 375 thousand square metres in 2010 to 1 million square metres in 2020 (ibid.).

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1 Fraunhofer IZM, Borderstep on behalf of the BMWi: Development of ICT-related electricity consumption in Germany, 2015

2 Borderstep on behalf of the eco-Verband: Bedeutung digitaler Infrastrukturen in Deutschland. Chancen und Herausforderungen für Rechenzentren im internationalen Wettbewerb, 2018 (The importance of digital infrastructures in Germany, Opportunities and challenges for data centers in international competition)

1.3 Objectives of the Environmental Label

The Blue Angel environmental label already formulated criteria for environmentally friendly data centers in 2012 and has revised them since then on a continuous basis. The existing environmental label for "Energy Efficient Data Center Operation" (DE-UZ-161) utilises an interdisciplinary approach covering all areas of a data center and its infrastructure. This system-based approach not only focuses on the energy efficiency of individual components but, in particular, also on the overall environmentally-conscious management of the data center. Operators of colocation data centers could only apply for this environmental label if their customers ensured compliance with the requirements for the efficient operation of the installed information technology. This represented an almost insurmountable hurdle in practice. Colocation suppliers can neither guarantee the energy efficiency of the customer's devices nor ensure the high utilization of the hardware. However, colocation suppliers can ensure that the building infrastructure and other infrastructure services are provided in a very energy and resource-efficient manner and thus create the conditions for the energy-efficient operation of the data center.
This environmental label for "Climate Friendly Colocation Data Centers" thus only addresses the building technology and areas that colocation suppliers can influence. In addition, the requirements stipulated by the environmental label create an incentive for colocation customers to use the information technology installed at the data center in the most energy efficient way possible.

The environmental label for "Climate Friendly Colocation Data Centers" (DE-UZ-NEW) may be awarded to those colocation data centers:

- whose building technology is operated in a particularly energy efficient and resource-conserving manner,
- whose operators develop and successfully implement a long-term strategy for increasing the energy and resource efficiency of the DC infrastructure,
- who motivate their customers to use energy-efficient information technology and
- who offer guaranteed minimum standards and transparent reporting to create the conditions for colocation customers to operate information technology in an environmentally friendly manner.

Therefore, following benefits for the environment and health are stated in the explanatory box:

1.4 Definitions

- **Gross floor area (GFA)** – Defined according to DIN 277-1, *Areas and volumes of buildings – Part 1: Building construction* as the sum of the floor areas for all horizontal areas of a building across all usable floors.

- **Colocation** – A service for the provision of space in a data center for customers to set up their own information technology. The data center space provided to the customer is offered with cooling services, a fail-safe power supply, a network connection and security technology as well as empty server racks if required. Another description for colocation is *housing*.
- **Colocation supplier** – A company that offers colocation as a service. The colocation supplier's area of responsibility covers the purchase of energy and the operation of the entire building infrastructure but not the purchase and operation of the customer's own information technology. The colocation supplier is the applicant for this environmental label.
- **Colocation data center** – The physical location where the colocation services are provided. A colocation data center is a building space in which infrastructure services and operational support for the customer's own information technology are provided.
- **Rack**– The housing in which servers, data storage devices, network devices and, where relevant, other IT components are enclosed and connected to supply lines. Racks are generally equipped with chassis rails or shelves.
- **Floor area** – Equivalent to the "constructed area". It is comparable to the floor space.
- **Commissioning of the data center** – The point in time when the data center begins to continuously supply services (provision of information technology, IT services or colocation) to internal or external customers.
- **Information technology (short: IT)** – This describes all devices that are used for entering, visualizing, processing, storing and transmitting data. In data centers, it includes above all servers, storage devices and network components.
- **White space** – The area within a data center in which the actual information technology from the colocation customers and the colocation supplier (servers, switches and data storage devices) is placed. The service areas between the individual racks are part of the white space.
- **Total IT performance** is the maximum IT performance for which the data centre was built or to which it has been expanded so far within the framework of a modular concept.
- **Energy Efficiency Ratio (EER)** – This describes the ratio of the annual cooling load for the cooling system to the total electrical energy input into the entire cooling system.
- **Cooling unit** - A unit that uses energy to periodically vaporise and liquefy a refrigerant held in an enclosed circuit, whereby the vaporisation process reduces the temperature of a medium (air, water) that is used to cool rooms or systems/processes.The refrigerant circuit (primary circuit) is connected to the media flow (secondary circuit) via a heat exchanger. Other names for cooling units are cooling plants, refrigeration units or air conditioning systems.
- **Cooling system** – The sum of all ventilation and air conditioning units used to cool rooms and systems. The systems can contain components such as cooling units, heat exchangers, free coolers, humidifiers and dehumidifiers, pumps, fans, valves, cold accumulators, filters and ducts. The energy efficiency ratio of a cooling system describes the annual cooling load for the cooling system to the total energy input into the system (see Appendix C).
- **Power Distribution Unit (PDU)** – This is the distribution unit within a rack (server and data cabinet) that distributes the low voltage electricity to the individual IT components. In order to enable sophisticated monitoring of energy consumption, so-called "intelligent PDUs" (iPDU) including devices that measure the performance values and energy consumption of the individually connected devices are fitted. The measurement values are transferred to a central monitoring system via a signal bus (e.g. LAN network).

- **Power Usage Effectiveness (PUE)** – A measure of how efficiently the data center infrastructure uses energy. It describes the ratio of the annual energy demand of the entire data center to the annual energy demand of the IT equipment (see DIN EN 50600-4-2).
- **Server** – This is a computer that is connected to the computer network and provides it with software services. In a data center, servers are generally installed in server racks.
- **Storage** - This is used for permanently saving large volumes of data. It is generally provided in the form of rotating hard drives (Hard Disk Drive - HDD), tape memory or flash memory (Solid State Disk - SSD).
- **Uninterruptible Power Supply (UPS)** – This is an apparatus within the energy supply system for the data center that increases the reliability of the energy supply. The UPS bridges short-term interruptions to the electricity supply grid using batteries and ensures that the power supply to the IT equipment is maintained until the load is covered by a substitute power supply system (e.g. an emergency power system - EPS). The UPS can also be used to ensure that the servers and storage systems can be properly shut down in the event of a prolonged power failure.

1.5 Information on submitting an application and compliance verification

The requirements for energy efficient colocation data centers formulated in these Basic Award Criteria are valid at both the time of application and also during the use of the environmental label. Compliance with these requirements must be verified at the time of application before the environmental label is awarded with the "Energy Efficiency Report at the time of application" and before the end of the term of contract with the "Energy Efficiency Report for final evaluation". The requirements stated in Paragraph 3 are split into the following subparagraphs:

- 3.1 Requirements at the time of application
- 3.2 Requirements during the term of the contract

When submitting an application, all of the compliance verifications stated in Paragraph 3.1 must be provided. The central document for verifying compliance with the requirements at the time of application is the Energy Efficiency Report according to Paragraph 3.1.5, which comprises general information on the data center, the building technology installed there and the results of the energy and IT monitoring.
This Energy Efficiency Report must be examined and confirmed by an independent auditor. RAL gGmbH, with the support of the Federal Environmental Agency, has approved auditors (see Annex 3) that are authorised to examine the submitted documentation. The approval of the auditors guarantees that the testing of the report is carried out independently and with a high level of professional qualifications.
During the term of the Contract on the Use of the Environmental Label, the data center must be operated in an energy efficient manner and energy efficiency criteria must be taken into account when acquiring new building technology. In this context, the requirements stated in Paragraph 3.2 must be observed.
Compliance with the requirements and the results of the monitoring must be documented in an Energy Efficiency Report for final evaluation and submitted to RAL gGmbH before the end of the term of contract by the deadline stated in Paragraph 3.2.2 . This final Energy Efficiency Report can be created by the label holder themselves. The report does not require external auditing.

2 Scope

This environmental label is awarded to colocation data centers, meaning the building space and technical building equipment used to offer colocation as a service (see Paragraph 1.4 Definitions).
The scope of this Basic Award Criteria includes data centres whose main purpose is the provision of co-location services. The main purpose is characterised by the fact that at least 50% of the area or the total IT performance is used or intended to be used by the IT of the co-location customers. For data centres that do not fall under this scope, the eco-label DE-UZ 161 "Energy-efficient data centre operation" must be applied.

Colocation suppliers that comply with the requirements in these Basic Award Criteria can apply for the environmental label. The environmental label is awarded for the part of the data center that is exclusively allocated for the provision of colocation services. The colocation data center must be identifiable by a fixed location and a unique designation. If a company operates multiple colocation data centers that are distributed over a variety of locations and/or operated independently of one another, each one represents a stand-alone colocation data center[3] for which it is necessary to apply for a separate environmental label.

3 Requirements

3.1 Requirements at the time of application

Verification of compliance with the requirements stated in Paragraph 3.1 must be submitted at the time of application. The Contract on the Use of the Environmental Label will be issued on this basis.

3.1.1 Building technology and energy provision

3.1.1.1 Power Usage Effectiveness (PUE)

Power Usage Effectiveness (PUE) is a measure of the energy efficiency of the data center's infrastructure. The PUE value must be determined in accordance with the DIN EN 50600-4-2 standard for PUE category 2 (PUE2, intermediate resolution) or using an equivalent method.
The applicant must specify the Power Usage Effectiveness (PUE) of the data center over a period of twelve months and document this value in the Energy Efficiency Report according to Paragraph 3.1.5. At the time of application, the end of the measurement period for determining the PUE must not be more than three months ago.
Depending on the date on which the data center was commissioned, the Power Usage Effectiveness (PUE) of the data center (see Paragraph 1.4 Definitions) must not exceed the following values:

Table 1: Minimum requirement for Power Usage Effectiveness

Date the data center was commissioned	PUE
01/01/2019 or later	PUE ≤ 1.30
Between 01/01/2015 and 31/12/2018	PUE ≤ 1.50
31/12/2014 or earlier	PUE ≤ 1.60

[3] IT system dependencies are not relevant.

Exemption 1: New data centers, which were commissioned less than 15 months ago at the time of the application, are exempt from the requirement that the PUE value must be calculated over a measurement period of twelve months. At the time of application, these data centers must calculate the expected PUE value 12 months after it has been commissioned based on the planning data according to DIN EN 50600 from a qualified specialist planner, in which the calculation of the PUE value reflects the expected status of the data center 12 months after it has been commissioned. These planning results must be documented in the Energy Efficiency Report (see Paragraph 3.1.5).
In the event that the exemption has been utilised for the application, the applicant must submit the measurement values for determining the PUE valve over a period of twelve months in accordance with the measurement rules stated above at the latest 15 months after the data center has been commissioned. The measurement results must verify compliance with the minimum requirements in Table 1.

Exemption 2: After they have been commissioned, newly built colocation data centers are often not yet working at full capacity. Therefore, the alternative minimum requirements for the PUE value stated in Table 2 are valid for the first two years after the commissioning of the data center (see Paragraph 1.4 Definitions). These exemptions are valid in each case for the reporting period for the Energy Efficiency Report. These exemptions can only be utilised at the time of application or during the use of the environmental label (see Paragraph 3.2 Requirements during the term of the contract) if the start of the reporting period for the Energy Efficiency Report is no longer than 2 years ago.

Table 2: Exemption for newly commissioned data centers

Date the data center was commissioned	**PUE**
Less than 1 year ago (commissioning date < 1 year)	PUE ≤ 1.50
Less than 2 years ago (1 year ≤ commissioning date < 2 years)	PUE ≤ 1.40
2 years or more before application (commissioning date ≥ 2 years)	See Table 1

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1 to the contract and document the calculation process and the PUE value in the Energy Efficiency Report as Annex 2 to the contract.
In the event that Exemption 1 has been utilised, the applicant shall demonstrate compliance with the requirement for Power Usage Effectiveness (PUE) by submitting the planning data according to DIN EN 50600 as an appendix to the Energy Efficiency Report. The auditor of the Energy Efficiency Report must verify the plausibility of the documentation. In addition, the applicant shall subsequently submit the PUE value based on measurements taken at the latest 15 months after the data center has been commissioned.
In the event that Exemption 2 has been utilised, the applicant shall verify based on the commissioning date of the data center that the start of the reporting period was less than 1 year or less than 2 years ago.

3.1.1.2 Energy efficiency of the cooling system

The energy efficiency ratio (EER) of the cooling system (CS) in a data center describes the ratio of the cooling load $Q_{th,DC,a}$ [MWh_{th}/a] in the data center that is handled by the cooling system

within one year (12 months) to the total electrical energy input into the entire cooling system $Q_{el,CS,a}$ [MWh_{el}/a].

$$EER = \frac{Q_{th,DC,a}}{Q_{el,CS,a}}$$

In cooling systems that are operated by means of electrically operated compression-type chillers, the EER must be determined using measurements carried out at the required measurement points in accordance with Appendix C "Determining the key values for the cooling system".
Depending on the date on which the cooling system was commissioned, the EER calculated in this way must comply with the values stated in Table 3 below:

Table 3: Minimum requirement for the energy efficiency of the cooling system (EER)

Date the cooling system was commissioned	**EER**
01/01/2019 or later	EER > 8
Between 01/01/2015 and 31/12/2018	EER > 7
31/12/2014 or earlier	EER > 5

The applicant shall state in the Energy Efficiency Report which options for waste heat recovery have been examined and the extent to which they have been realised.

Exemption 1: New data centers, which were commissioned less than 15 months ago at the time of the application, are exempt from the requirement that the EER value must be calculated over a measurement period of twelve months. The expected EER value for these data centers after 12 months must be calculated as follows:
Either based on planning data from a qualified specialist planner, in which the calculation of the EER value reflects the expected status of the data center 12 months after it has been commissioned.
Or on the basis of a load test, where the expected status of the data center after 12 months is simulated using load banks and then used to calculate the annual cooling load for the cooling system and the total electrical energy input into the entire cooling system.
In the event that this exemption is utilised, the planning results or the results of the load test must be documented in the Energy Efficiency Report (see Paragraph 3.1.5). In addition, the applicant must submit the measurement values for calculating the EER valve over a period of twelve months in accordance with the measurement rules stated above at the latest 15 months after the data center has been commissioned. The measurement results must verify compliance with the minimum requirements in Table 3 .

Exemption 2: In the event that absorption chillers are used, the EER value does not need to be calculated as described above. Instead, the specific greenhouse gas emissions [kg_{CO2e}/kWh_{th}] associated with the cooling output must be calculated and the value documented in the Energy Efficiency Report. The specific greenhouse gas emissions for the absorption chiller (F_{ATC}) may not exceed the greenhouse gas emissions from electrically operated compression-type chillers (F_{CTC}). In order to determine the specific greenhouse emissions, the calculation guidelines described in Appendix C Determining the key values for the cooling system must be followed.

Exemption 3: After they have been commissioned, newly built colocation data centers are often not yet working at full capacity. Therefore, the alternative minimum requirements for the EER value stated in Table 4 are valid for the first two years after the commissioning of the data center (see Paragraph 1.4 Definitions). These exemptions are valid in each case for the reporting period for the Energy Efficiency Report. These exemptions can only be utilised at the time of application or during the use of the environmental label (see Paragraph 3.2 Requirements during the term of the contract) if the start of the reporting period for the Energy Efficiency Report is no longer than 2 years ago.

Table 4: Exemption for newly commissioned data centers

Date the data center was commissioned	**EER**
Less than 1 year ago (commissioning date < 1 year)	EER > 5
Less than 2 years ago (1 year ≤ commissioning date < 2 years)	EER > 6.5
2 years or more before application (commissioning date ≥ 2 years)	See Table 3

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1 to the contract and document the amounts of energy ($Q_{th,DC,a}$ and $Q_{el,CS,a}$) and the energy efficiency ratio (EER) as well as the tested and implemented options for waste heat recovery in the Energy Efficiency Report in Annex 2 to the contract.
In the event that Exemption 1 has been utilised, the applicant shall demonstrate compliance with the requirement for the energy efficiency ratio (EER) by submitting the planning data or a measurement report for the load test as an appendix to the Energy Efficiency Report. In addition, the applicant shall subsequently submit the EER value based on measurements taken at the latest 15 months after the data center has been commissioned.
If absorption chillers are installed in the cooling system, the applicant shall calculate the specific greenhouse gas emissions (F_{ATC}) for the cooling output in accordance with Exemption 2 and document this value in an appendix to the Energy Efficiency Report (Annex 2). In the event that Exemption 3 has been utilised, the applicant shall verify based on the commissioning date of the data center that the start of the reporting period was less than 1 year or less than 2 years ago. If one of the exemptions has been utilised, the auditor of the Energy Efficiency Report must verify the plausibility of the calculations.

3.1.1.3 Refrigerant

For the cooling of the data center, only halogen-free refrigerants may be used in cooling systems that were placed into operation after the 01/01/2013. Systems that were placed into operation before this date may only use chlorine-free refrigerants.

Exemption: An exemption is made for cooling units with a maximum cooling performance of 10 kWth used for cooling separate ambient spaces (according to method 5.2.18 of the DIN CLC/TR 50600-99-1 standard). The use of refrigerants containing halogens must be justified in these cases. The parallel switching of multiple cooling units of this type to achieve a higher cooling performance is not permissible.

Compliance verification

The applicant shall declare compliance with the requirements in Annex 1 to the contract and name the refrigerant and the quantity of refrigerant used in the Energy Efficiency Report (Annex 2).

3.1.1.4 Electrical energy

The data center must cover 100 % of its electricity demand from renewable energies such as hydroelectric power, photovoltaic power, wind power or biomass power. Alternatively, electricity from decentralised combined heat and power plants can also be used.

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1 to the contract and submit the electricity labelling data in accordance with Article 42 of the German Energy Act (Energiewirtschaftsgesetz) as Annex 5 to the contract that provides information on at least the CO_2 emissions [g/kWh] and the proportion of the electricity mix accounted for by renewable energies (subsidised according to the German Renewable Energies Act (EEG) and non-subsidised renewable energies). A specific verification based on the system used in the German Energy Act can be submitted for the share of the electricity accounted for by the data center's own systems for power generation. The auditor of the Energy Efficiency Report must verify the plausibility of the documentation.

3.1.2 Efficient use of floor space

In order to help reduce soil sealing, the data center should make the most efficient use of space possible. In the Energy Efficiency Report, the applicant shall state the following key values as information about his/her efficient use of floor space:

- Total IT performance per square meter of gross floor area [kW_{el}/m^2_{GFA}]
- Total IT performance per square meter of floor area (constructed area) [kW_{el}/ m^2_{FA}]

Compliance verification

The applicant shall state the key values for the efficient use of floor space described above in Annex 1 to the contract and in the Energy Efficiency Report in Annex 2.

3.1.3 Incentives for saving energy

The applicant must support his/her colocation customers to record and reduce the energy consumption of the information technology they have installed. The applicant must provide them with monitoring information for this purpose and design the colocation contracts in such a way that customers have an incentive to save energy.

3.1.3.1 Obligation to provide information

The applicant undertakes to regularly (at least on a monthly basis) provide his/her colocation customers with information about the amount of electrical energy consumed and the electrical peak load by the information technology installed by the respective customer:

- Electricity consumption [kWh_{el}]
- Electrical peak load [kW_{el}]

The colocation supplier must inform his/her customers about the possibilities for saving energy and support them in their implementation. The supplier must also provide his/her customers with corresponding information material for this purpose.

In terms of the building technology and energy provision, the colocation data center labelled with the environmental label must meet the requirements that would enable colocation customers to apply for the environmental label DE-UZ-161 "Energy Efficient Data Center Operation". The colocation supplier is obligated to support his/her customers with their application for the environmental label by providing relevant information on the PUE, EER, refrigerant and energy.

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1 to the contract and submit the corresponding information material on energy savings as Annex 6 to the contract.

3.1.3.2 Consumption-based billing

The billing of the colocation services must be designed in such a way that both the supplier and also the customers have an incentive to consume as little energy as possible and to operate the equipment installed at the data center in the most energy efficient way possible. In order to achieve this, the energy costs billed to the customer must reflect the actual costs as far as possible.

The energy costs must be billed based on the electricity consumption of the information technology installed by the customer ($ElectricityConsumption_{Customer}$), a defined electricity price ($ElectricityPrice_{Customer}$) and a previously announced Power Usage Effectiveness (PUE) value:

$$EnergyCosts_{Customer}\ [€/\text{time unit}] =$$

$$ElectricityConsumption_{Customer}\ [kWhel/\text{time unit}] * ElectricityPrice_{Customer}\ [€/kWhel] * PUE$$

For customers with their own space, a partial PUE must be calculated annually for each customer ($_{p}PUE_{Partial}$ according DIN EN 50600-4-2). Some spaces or partial systems are physically separated by walls and doors that largely prevent the room temperatures being influenced by third-party information technology. For these customers, the change in the partial PUE ($_{p}PUE_{Partial}$) must provide them with an incentive to save energy.

For all other customers, an overall PUE for the entire data center, as stated in the application (see Paragraph 3.1.1.1), or an updated PUE value for the respective billing period can be used. The electricity price can be agreed once with the customer or can also be adjusted based on, for example, a price escalation clause for the relevant electricity purchased.

It is not permitted to agree either a minimum purchase quantity or a fixed amount of electrical energy [kWh_{el}] provided free of charge with the customer.

Other cost components could include the level of the peak electrical load [kW_{el_peak}] used by the customer (the electrical load is generally calculated as an average value over a 15 minute interval) or other flat-rate cost components not related to energy (e.g. for space, racks, network devices, services, etc.).

The applicant must demonstrate that the colocation services are billed as the sum of the energy costs, costs for the provision of electricity and flat-rate costs (overheads and other costs) as follows, whereby the costs for the provision of electricity and the flat-rate costs are optional:

Billed costs [€/time unit] =

$ElectricityConsumption_{Customer}$ [kWh_{el}/time unit] * $ElectricityPrice_{Customer}$

[€/kWh_{el}] * PUE (+ $PeakLoad_{Customer}$ [kW_{el}/time unit] * ElectricityProvisi-

$onCosts_{Customer}$ [€/kW_{el}])

(+ flat-rate costs [€/time unit])

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1 to the contract, state the electricity price [€/kWh_{el}] valid for customers at the time of application and organise its billing terms around the cost components of consumption costs, electricity provision costs and flat-rate costs. In addition, the applicant shall submit a sample contract for the billing of the colocation services as Annex 7 to the contract in which this allocation of costs can be seen. The auditor of the Energy Efficiency Report must verify the plausibility of the electricity price calculations.

3.1.4 Energy Efficiency Report at the time of application

An Energy Efficiency Report must be submitted at the time of application that provides information on the current technical status of the data center. In addition, the Energy Efficiency Report must document compliance with all of the requirements that are valid at the time of application according to Paragraphs 3.1.1 to 3.1.3. The information required for the creation of the Energy Efficiency Report is listed in the document template in Annex 2 of the Basic Award Criteria.

The Energy Efficiency Report must be examined by one of the approved auditors (see Paragraph 1.5). The auditor must confirm in the form of an audit report that the information stated in the energy efficiency report has been provided in full and is highly plausible.

Compliance verification

The applicant shall submit a fully completed Energy Efficiency Report as Annex 2 to the contract. The Energy Efficiency Report can be provided by the applicant either using the document template in Annex 2 to the contract or in another suitable form, such as a printout from an online tool or a spreadsheet program. However, the report must contain the structure (Paragraph headings) and the information requested in Annex 2 to the contract.

The applicant shall declare compliance with the requirement in Annex 1 to the contract and submit an audit report as Annex 4 to the contract from one of the auditors approved in Annex 3 that confirms that the applicant has provided at least the required information in full and with a high level of plausibility.

3.2 Requirements during the term of the contract

3.2.1 Building technology and energy monitoring

3.2.1.1 Monitoring of the electrical energy and water

Monitoring must be carried out by the applicant in which measurements of the electrical output and the energy consumption of the important components of the data center, as well as the water consumption, are recorded and evaluated continuously throughout the whole year. For this purpose, the measurement points in accordance with Appendix B: Measurement concept, as well as further measurement points for determining the Energy Efficiency Ratio (EER) of the cooling system, must be set up as a minimum and measurements taken on a regular basis.
The following values must be determined through this energy monitoring on at least an annual basis:

- Power Usage Effectiveness (PUE) (see Paragraph 3.1.1.1)
- Energy Efficiency Ratio (EER) of the cooling system (see Paragraph 3.1.1.2)

The following values must be determined through this energy monitoring on at least a monthly basis (see Appendix B Measurement concept):

- Electricity demand of the entire DC (MPESC + MPOSG) [kWhel]
- Electricity demand of the IT equipment (MPIT2) [kWhel][4]
- Electricity demand of the cooling system (MPCS) [kWhel]
- Electricity demand of other consumers (MPOC) [kWhel]
- Cooling load of the entire DC [kWhth]
- Total water consumption in DC [m³] and water quality [drinking water | grey water | rain-water]

Compliance verification

The holder of the environmental label shall document the results of the energy monitoring in Annex 2e (Energy Monitoring) and submit it together with the Energy Efficiency Report for final evaluation (Annex 2) according to Paragraph 3.2.2 by the stated deadline. The documentation shall include, as a minimum, those values that must be determined on a monthly basis as a time series according to the requirements.

3.2.1.2 Acquisition of new components for the cooling system

If new components are acquired for the cooling system, the energy efficiency ratio (EER) of the cooling system must not be worse (smaller) than the EER at the time of application.
The energy efficiency ratio (EER) of the cooling system must be determined and documented in accordance with the rules defined in Paragraph 3.1.1.2 Energy efficiency of the cooling system.

[4] Sum of all billed electricity demands attributable to the customer and the electricity demand for the operation of the information technology attributable to the colocation supplier (e.g. IT for monitoring, GLT, etc.)

In the case of newly acquired cooling units, no halogenated hydrocarbons may be used as a refrigerant.

Compliance verification

The holder of the environmental label shall document the newly installed components for the cooling system in the Energy Efficiency Report for final evaluation according to Paragraph 3.2.2 and name the refrigerant, the quantity of refrigerant used and the energy efficiency ratio (EER) of the cooling system in this report.
In the event that the exemptions described in Paragraphs 3.1.1.2 and 3.1.1.3 have been utilised, verification in accordance with the verification requirements in these paragraphs shall be submitted in addition to the Energy Efficiency Report for final evaluation.

3.2.1.3 Acquisition of new Uninterruptible Power Supply (UPS) systems

If new uninterruptible power supply systems are acquired, the following minimum requirements for their efficiency must be fulfilled. In double conversion mode, the efficiency of the uninterruptible power supply must not be lower than:

- 92 % at an electrical output of 100 % of the nominal output
- 95 % at an electrical output of 75 % of the nominal output
- 95 % at an electrical output of 50 % of the nominal output
- 90 % at an electrical output of 25 % of the nominal output

Exemption: In the case of parallel redundant UPS systems whose modular ("scalable") design allows for a gradual increase in the power output (e.g. due to the use of additional information technology), the newly purchased modules must be at least as efficient as the existing modules. However, there are no other minimum requirements for their efficiency.

Compliance verification

The holder of the environmental label shall document the newly acquired UPS systems in the Energy Efficiency Report for final evaluation according to Paragraph 3.2.2 and state their efficiency levels in this report.

3.2.1.4 Acquisition of new switching systems

Newly acquired medium-voltage and low-voltage switching systems may not contain the highly potent greenhouse gas sulphur hexafluoride (SF6) as an insulation medium. SF6-free switching systems must be acquired.

Compliance verification

The holder of the environmental label shall document the newly acquired switching systems in the Energy Efficiency Report for final evaluation according to Paragraph 3.2.2 and state the insulation medium used in this report.

3.2.1.5 Acquisition of new intelligent Power Distribution Units (PDUs)

The power losses from newly acquired intelligent power distribution units (iPDUs, see Paragraph 1.4 Definitions) must not be greater than 0.5 W per available power outlet (power socket or connection terminal).

Compliance verification

The holder of the environmental label shall document the newly acquired intelligent power distribution units (iPDUs) in the Energy Efficiency Report for final evaluation according to Paragraph 3.2.2 and state their power losses per power outlet in this report.

3.2.1.6 Taking into account life cycle costs when making acquisitions

The applicant obligates themselves to carry out a calculation of the life cycle costs for the planned period of use (e.g. investment costs, maintenance and energy costs, disposal costs) when acquiring new equipment and systems and to take this into account when evaluating quotations.

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1 to the contract.

3.2.2 Energy Efficiency Report for final evaluation

The holder of the environmental label must submit an Energy Efficiency Report at the latest 6 months before the end of the agreed term of contract in which compliance with the requirements during the term of the contract is documented. The reporting period must cover a period from the beginning of the term of contract through to at least 9 months before the end of the term of contract.
The Energy Efficiency Report for final evaluation primarily consists of information that was collected based on the requirements in Paragraph 3.2.1 during the term of the contract (results of the monitoring, documentation for newly acquired building technology).
If the holder of the environmental label does not fulfil his/her obligation to submit an Energy Efficiency Report for final evaluation or the report shows that the requirements placed on the data center or the operation of the data center have not been complied with, this represents an infringement of the Contract on the Use of the Environmental Label (see Paragraph 5) and can be sanctioned by RAL gGmbH with the removal of permission to use the environmental label. It is only possible to award the environmental label again if the Efficiency Report for final evaluation has been submitted.

Exemption: If the end of the reporting period for the Energy Efficiency Report at the time of application according to Paragraph 3.1.5 was less than 12 months ago at the deadline for submitting this report (6 months before the end of the term of the contract), it is not necessary to submit the Efficiency Report for final evaluation.

Compliance verification

The holder of the environmental label shall submit an Energy Efficiency Report for final evaluation and an updated Annex 2e (Energy Monitoring) at the latest 6 months before the end of the term of the contract.

4 Applicants and Parties Involved

Operators of data centers or providers of data center services according to Paragraph 2 shall be eligible for application.

Parties involved in the award process are:
- RAL gGmbH to award the Blue Angel Environmental Label,
- the federal state being home to the applicant's production site,
- Umweltbundesamt (German Environmental Agency) which after the signing of the contract receives all data and documents submitted in applications for the Blue Angel in order to be able to further develop the Basic Award Criteria.

5 Use of the Environmental Label

The use of the Environmental Label by the applicant is governed by a contract on the use of the Environmental Label concluded with RAL gGmbH.

Within the scope of such contract, the applicant undertakes to comply with the requirements under Paragraph 3 while using the Environmental Label.

Contracts on the Use of the Environmental Label are concluded to fix the terms for the certification of products under Paragraph 2. Such contracts shall run until December 31, 2023.
They shall be extended by periods of one year each, unless terminated in writing by March 31, 2023 or March 31 of the respective year of extension.
After the expiry of the contract, the Environmental Label may neither be used for labelling nor for advertising purposes. This regulation shall not affect products being still in the market.

The applicant (manufacturer) shall be entitled to apply to RAL gGmbH for an extension of the right to use the ecolabel on the product entitled to the label if it is to be marketed under another brand/trade name and/or other marketing organisations.

The Contract on the Use of the Environmental Label shall specify:
- Applicant (Owner/Operator of the data center)
- Brand/trade name, product description
- Location, detailed description of the data center

Appendix A Cited legislations and standards, literature

The observance of relevant existing laws and legal requirements is a prerequisite for those products used in the data center. In particular, the following legal requirements must be observed:

[1] The WEEE Directive (2012/19/EU)[5] implemented in German law in the Electrical and Electronic Equipment Act (ElektroG)[6]that regulates the disposal of products.

[2] The ROHS Directive (2011/65/EU)[7] implemented in German law in the German Material Ordinance for Electrical and Electronic Equipment (ElektroStoffV)[8]that regulates the pollutant content of products.

[3] The External Power Supplies Directive (278/2009/EC)[9] that regulates the ecodesign requirements for external power supplies.

[4] The F-Gas Regulation (517/2014/EU)[10], which regulates the gradual phasing out of the use of partly fluorinated hydrocarbons (HFC).

[5] The ecodesign regulation for cooling systems and heat pumps (2281/2016/EU)[11]

[6] DIN 277-1, Areas and volumes of buildings - Part 1: Building construction

[7] DIN EN ISO 50001, Energy management systems - Requirements with guidance for use

[8] DIN EN 50600-4-2, Information technology - Data centre facilities and infrastructures - Part 4-2: Power Usage Effectiveness

[9] DIN CLC/TR 50600-99-1, Information technology - Data centre facilities and infrastructures - Part 99-1: Recommended practices for energy management

[10] DIN V 18599, Energy efficiency of buildings - Calculation of the net, final and primary energy demand for heating, cooling, ventilation, domestic hot water and lighting

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5 Directive 2012/19/EU on waste electrical and electronic equipment (new version); WEEE Directive

6 Law for the sale, return and environmental disposal of electrical and electronic equipment, Electrical and Electronic Appliance Act from 20 October 2015 (BGBl. I P. 1739); ElektroG

7 Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (new version); ROHS Directive

8 Ordinance to limit the use of hazardous substances in electrical and electronic equipment (Material Ordinance for Electrical and Electronic Equipment); ElektroStoffV

9 Regulation (EC) No. 278/2009 implementing directive 2009/125/EC (previously: 2005/32/EC) with regard to ecodesign requirements for no-load condition electric power consumption and average active efficiency of external power supplies; External Power Supplies Directive

10 Regulation (EU) No. 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006, F-Gas Regulation

11 Commission Regulation (EC) No. 2016/2281 of 30 November 2016 implementing Directive 2009/125/EC of the European Parliament and of the Council establishing a framework for the setting of ecodesign requirements for energy-related products, with regard to ecodesign requirements for air heating products, cooling products, high temperature process chillers and fan coil units

Appendix B Measurement concept

The installation of measurement technology creates the prerequisites for the continuous measurement of the electrical output and energy consumption of the most important components of the data center. This requires the implementation of a measurement concept comprising at least the following measurement points. In this process, the individual measurement points can be realised using multiple measurement locations or reference measurements that enable the relevant measurement results to be calculated.

- MP_{ESC}: Measurement point for the electricity supply company: electrical power and electrical work for supplying the data center by the electricity supply company (ESC)
- MP_{OSG}: Measurement point for own systems of power generation: electrical power and electrical work of the data center's own systems for power generation (if available)
- MP_{CS}: Measurement point for the cooling system: electrical power and electrical work for the cooling system (cooling plants, free cooling / heat exchanger, humidifier/dehumidifier, pumps and valves)
- MP_{UPS}: Measurement point for UPS: electrical power and electrical work input into the uninterruptible power supply
- MP_{IT1}: Measurement point for IT 1: electrical power and electrical work output from the uninterruptible power supply
- MP_{IT2}: Measurement point for IT 2: electrical power and electrical work for supplying the ICT system
- MP_{OC}: Measurement point for energy consumers: electrical power and electrical work for the other energy consumers (e.g. measurement, management and control technology, lighting, small consumers, fire and hazard protection equipment)

The following schematic diagram shows the arrangement of the measurement points:

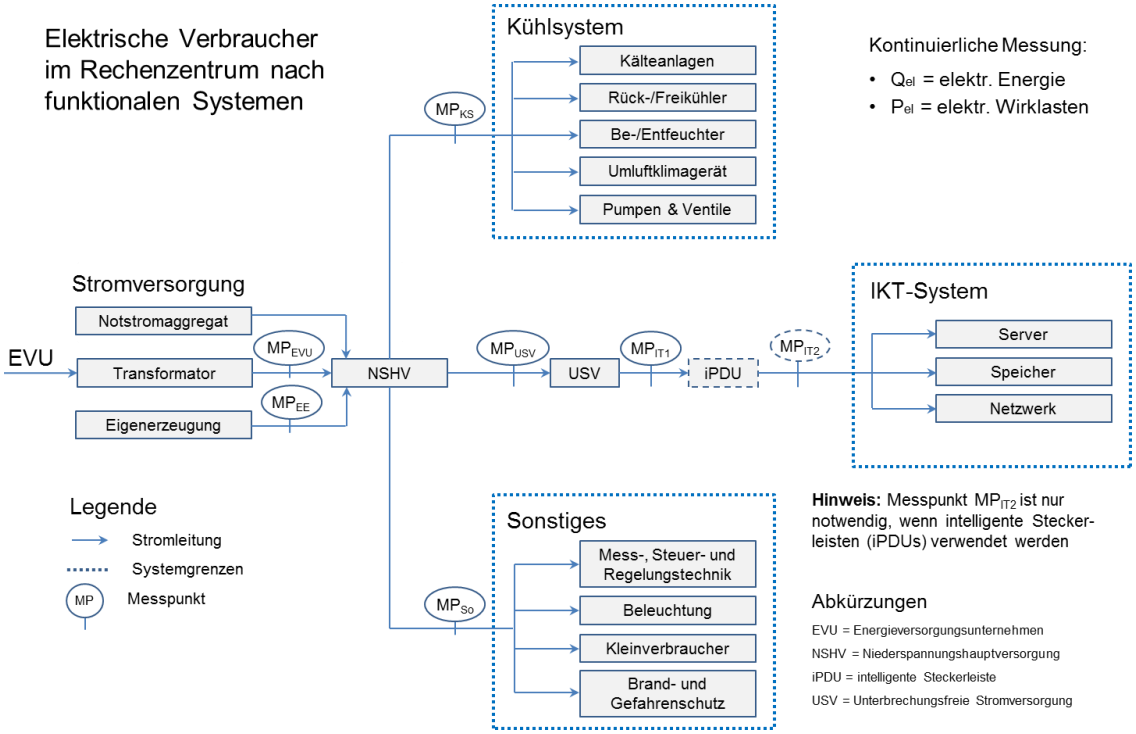

Figure 1: Measurement of the main components of a data center

Appendix C Determining the key values for the cooling system

1 Determining the energy efficiency ratio (EER)

The energy efficiency ratio (EER) of the cooling system in a data center describes the ratio of the cooling load in the data center that is handled by the cooling system within one year (12 months) to the total electrical energy input into the entire cooling system.
The annual cooling load for the cooling system ($Q_{th,DC,a}$, [kWh/a]) is determined in accordance with VDI Guideline 2078 as the sum of all electrical losses in the rooms being cooled.
The total electrical energy supplied to the entire cooling system ($Q_{el,CS,a}$, [kWh/a]) per year is determined in accordance with the DIN V 18599 standard from the electrical energy input into all of the components in the entire cooling system (i.e. also including the operating power for fans, pumps, re-cooling systems or absorption chillers).
Both energy values must be determined through measurements in accordance with the measurement concept in Figure 1 and presented for a period of 12 months.

$$Q_{el,CS,a} = MP_{CS}$$

The energy efficiency ratio (EER) is then calculated as follows:

$$EER = \frac{Q_{th,DC,a}}{Q_{el,CS,a}}$$

2 Determining the specific greenhouse gas emissions of absorption chillers

In the event that absorption chillers are utilised, the specific greenhouse gas emissions for the cooling output (F_{ATC}) must be calculated and documented annually.

The following calculation steps must be carried out:

- Calculation of the thermal Energy Efficiency Ratio for a cooling system with an absorption chiller (EER_{th}):

$$EER_{th} = \frac{Q_{th,DC,a}}{Q_{th,Input\_CS,a}}$$

- Calculation of the electrical energy efficiency ratio for a cooling system with an absorption chiller (EER_{el}):

$$EER_{el} = \frac{Q_{th,DC,a}}{Q_{el,CS,a}}$$

- Calculation of the specific greenhouse gas emissions for the cooling supply:

$$F_{ATC} = \frac{Q_{el,CS,a} \times F_{el} + Q_{th,Input\_CS,a} \times F_{th}}{Q_{th,DC,a}} = \frac{F_e}{EER_{el}} + \frac{F_t}{EER_{th}}$$

$[kg_{CO2e}/kWh_{th}]$

Using the emissions factor for electricity from the German electricity mix (F_{el}) in 2017[12]:

$F_{el} = 0.486\ kg_{CO2e}/kWh_{el}$

As an alternative to this value, the currently valid emission factors for the relevant electricity can be used. The calculation also includes the emission factor for thermal energy (F_{th}) based on the energy source used. The source of the relevant emission factor must be documented for the calculation. In the following table, some energy sources are shown as examples:

Table 5: Emission factor for thermal energy(Fth) based on the energy source used

Energy source	Fth
Heating oil HH/GHD	0.319 kgCO2e/kWhth
Natural gas HH/GHD	0.250 kgCO2e/kWhth
Liquefied gas HH/GHD	0.277 kgCO2e/kWhth
Wood pellets	0.027 kgCO2e/kWhth
Wood chips	0.019 kgCO2e/kWhth

Examples for emission factors, source GEMIS 4.95[13]

For comparison with the cooling supply from a cooling system with electrically operated compression-type chillers, it is necessary to also calculate the specific greenhouse gas emissions with alternative compression-type chillers as follows:

$$F_{CTC} = \frac{F_e}{EER_{el\_CTC}} \times 1.1\ [kg_{CO2e}/kWh_{th}]$$

The minimum requirements from the Basic Award Criteria (Paragraph 3.1.1.2) must also be applied for the energy efficiency ratio for cooling systems with compression-type chillers (EER_{el_CTC}).
The factor 1.1 within the formula for calculating the specific greenhouse gas emissions for cooling systems with compression-type chillers (F_{CTC}) takes into account the impact on the climate caused by direct refrigerant emissions from the compression-type chillers.

[12] Data source: UBA 2019, Development of the specific carbon monoxide emissions from the German electricity mix in the years 1990 to 2018, Internet: https://www.umweltbundesamt.de/publikationen/entwicklung-der- spezifischen-kohlendioxid-5

[13] Data source: IINAS GmbH, GEMIS 4.95, April 2017, Scenario for heating and process heat systems, end-energy-based 2010 [kWh], Internet: http://iinas.org/tl_files/iinas/downloads/GEMIS/2017_GEMIS-Ergebnisse-Auszug.xlsx

In order to verify that the specific greenhouse gas emissions for the absorption chiller do not exceed the greenhouse gas emissions for the electrically operated compression-type chiller, the following conditions must be fulfilled:

$$F_{ATC} \leq F_{CTC} \quad [kg_{CO2e}/kWh_{th}]$$

The value for F_{ATC} must be documented in an annual time series. The comparative value F_{CTC} must be given in each case.