**Annex 2**

**Energy Efficiency Report**

**to the Basic Award Criteria for the Environmental Label DE-UZ 161**

**for Energy Efficient Data Center Operation**

|  |  |  |
| --- | --- | --- |
| Type of report: | Energy Efficiency Report at the time of application  Energy Efficiency Report for final evaluation | |
| Applicant/label holder: | |  |
| Address: | |  |
| Name of DC: | |  |
| Location of DC: | |  |
| Date DC commissioned: | |  |
| Date of application: | |  |
| Date label awarded: | |  |
| Author: | |  |
| Reporting period: | | from:       to: |
| Date report created: | |  |

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# Introduction

This Energy Efficiency Report is submitted at the time of application and for the final evaluation of the requirements of the Blue Angel environmental label for energy efficient data center operation (DE-UZ 161). This template document, which defines the structure of the Energy Efficiency Report, is enclosed with the Basic Award Criteria for DE-UZ 161 as Annex 2.

This report can be used as a template for the **“Energy Efficiency Report at the time of application”** (see Paragraph 3.1.3 of the Basic Award Criteria) and for the **“Energy Efficiency Report for final evaluation”** (see Paragraphs 3.2.3 of the Basic Award Criteria).

This Energy Efficiency Report must be examined by an independent auditor to confirm compliance with the requirements. 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 data centers or infrastructure technology (e.g. cooling systems, UPS). In this context, the requirements stated in Paragraph 3.2 of the Basic Award Criteria must be observed.

The **“Energy Efficiency Report at the time of application”** must be submitted to RAL gGmbH by the applicant **at the time the application is made**. The following aspects must be observed in this process:

1. Part 1 of the report is used to provided general information about the data center.
2. Part 2 of the report is used to document compliance with all requirements that are valid at the time of application.
3. Part 2 of the report contains additional fields that must be completed if this report is being used as a template for the “Energy Efficiency Report for final evaluation” (see below).
4. The “Energy Efficiency Report at the time of application” must be examined by an independent auditor to confirm its plausibility.

An **“Energy Efficiency Report for final evaluation”** must be submitted to RAL gGmbH at the latest 6 months before the end of the agreed term of contract. The “Energy Efficiency Report for final evaluation” can be submitted as a continuation and update of the “Energy Efficiency Report at the time of application”. It needs to be updated for this purpose and supplemented to include the fields found in Part 2 under the heading »The following is valid for the continued use of this report as the “Energy Efficiency Report for final evaluation”:«.The “Energy Efficiency Report for final evaluation” does not require external auditing.

# Reading aid

The following Table 1 provides an overview of the annexes to the contract on the use of the environmental label for “energy efficient data center operation” DE-UZ 161 and explains their contents, as well as their function at the time of application and for the final evaluation (also see at the end of this document: Overview of the annexes to the contract).

Table 1: Overview of the annexes to the contract

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Annex** | **Contents** | **Template available** | **Part of the application** | **Part of the final evaluation** |
| Annex 1 | The applicant shall declare compliance with the requirements for the environmental label | Yes | Yes | No |
| Annex 2 | Energy Efficiency Report at the time of application | Yes | Yes | No |
| Annex 2 | Energy Efficiency Report for final evaluation | Yes | No | Yes |
| Annex 2a | Energy Efficiency Report (Excel table):  IT Inventory List for Servers | Yes | Yes | Yes |
| Annex 2b | Energy Efficiency Report (Excel table):  IT Inventory List for Storage Systems | Yes | Yes | Yes |
| Annex 2c | Energy Efficiency Report (Excel table):  IT Inventory List for Network Equipment | Yes | Yes | Yes |
| Annex 2d | Energy Efficiency Report (Excel table):  Acquisition of New PDUs | Yes | No | Yes |
| Annex 2e | Energy Efficiency Report (Excel table): Energy Monitoring | Yes | Yes | Yes |
| Annex 2f | Energy Efficiency Report (Excel table): Monitoring of the IT load | Yes | Yes | Yes |
| Annex 3 | List of Auditors | Yes | No | No |
| Annex 4 | Report by the auditor | No | Yes | No |
| Annex 5 | Verification about the energy provision or electricity labelling according to Article 42 of the German Energy Act (Energiewirtschaftsgesetz) | No | Yes | No |

The following Table 2 serves to allocate the relevant paragraphs in the Basic Award Criteria for DE-UZ 161 Edition January 2019 to the relevant sections in this Energy Efficiency Report and the annexes.

Table 2: Allocation of the paragraphs in the Basic Award Criteria to the sections in Annex 2

|  |  |  |
| --- | --- | --- |
| **Paragraph in the  Basic Award Criteria** | **Section of the  Energy Efficiency Report** | **Annexes** |
| **3.1.1 Building technology and energy provision** |  |  |
| 3.1.1.1 Power Usage Effectiveness (PUE) | 2.1 Determining the Power Usage Effectiveness at the time of application |  |
| 3.1.1.2 Energy efficiency of the cooling system | 2.6.2 Energy efficiency of the cooling system (calculation of the energy efficiency ratio) |  |
| 3.1.1.3 Refrigerant | 2.6.1 General information on the cooling system, Subsection no. 7 |  |
| 3.1.1.4 Electrical energy | 2.2 Electrical energy | Annex 5 |
| **3.1.2 Information technology and IT management** |  |  |
| 3.1.2.1 creation of an inventory list | 2.4 IT inventory list | Annexes 2a – 2c |
| 3.1.2.2 Monitoring of the IT load | 2.5.1 Monitoring of the IT load | Annex 2f |
| 3.1.2.3 Minimum load of the servers | 1.4 Servers and installed CPUs, Subsection no. 6 |  |
| **3.2.1 Building technology and energy management** |  |  |
| 3.2.1.1 Monitoring electrical energy | 2.5.2 Monitoring electrical energy (monthly and annually) | Annex 2e |
| 3.2.1.2 Acquisition of new components for the cooling system | 2.6.1 General information on the cooling system, Subsection no. 7 + 2.6.2 Energy efficiency of the cooling system (calculation of the energy efficiency ratio) |  |
| 3.2.1.3 Acquisition of new Uninterruptible Power Supply (UPS) systems | 2.7 Uninterruptible Power Supply (UPS) |  |
| 3.2.1.4 Acquisition of new switching systems | 2.3 Electrical switching systems |  |
| **3.2.2 Information technology and IT management** |  |  |
| 3.2.2.1 Continued use of the IT inventory list | 2.4.1 Continued use of the IT inventory list, 2.4 IT inventory list | Annexes 2a – 2fd |
| 3.2.2.2 Monitoring of the IT load | 2.5.1 Monitoring of the IT load | Annex 2f |
| 3.2.2.3 Acquisition of new servers | 2.4.2 Acquisition of new servers | Annex 2a |
| 3.2.2.4 Acquisition of new energy efficient external power supplies | 2.4.3 Acquisition of new energy efficient external power supplies | Annex 2a |
| 3.2.2.5 Acquisition of new intelligent power distribution units (PDUs) | 2.4.1 Continued use of the IT inventory list | Annex 2d |
| 3.2.2.6 Taking into account life cycle costs when making acquisitions |  | Annex 1 |

# Part 1: General information on the data center

## Floor space, operating concept and classification

1. Floor space of the data center (DC)
   1. What is the **maximum** floor space you can use at your data center for computer, storage and network components?       m2
   2. What is the floor space you **currently** use at your data center for computer, storage and network components?       m2

⇨ If 1.1 is greater than 1.2, please continue with 1.3, otherwise please jump to 1.3.2.

* 1. Do you plan to extend your data center on the current floor space? (Yes/No)

⇨ If Yes:

* + 1. Does the maximum floor space available (Question 1) set a limit on the further extension of your data center? (Yes/No)
    2. Does the power supply, e.g. the maximum connected loads, limit the extension of your data center? (Yes/No)
    3. Are there any other limits to the extension of your data center? (Yes/No)
  1. Please assign your data center to one (or more) of the functional type(s) based on the different data center owners/operators.

|  |  |  |
| --- | --- | --- |
|  | **Type** | **Function** |
|  | Operator | Operates the entire data center and controls all elements (building, power supply, air conditioning and IT equipment). |
|  | Colocation  Provider | Operates the data center for the primary purpose of selling or leasing space, power and cooling capacity to customers who will install and manage their own IT hardware and services. |
|  | Colocation  Customer | Owns and manages IT equipment located in a data center. A Colocation Customer purchases or rents space, power and cooling capacity in a data center from a Colocation Provider. |
|  | Managed Service Provider (MSP) | Owns and manages the data center space, power, cooling capacity, IT equipment and parts of the software in order to provide customers with IT services. This includes conventional IT outsourcing. |
|  | Managed Service Provider (MSP)  in Colocation | A managed service provider that rents/purchases space, power or cooling capacity in a data center from a Colocation Provider (and does not manage the facility themselves). |

Source: EU Code of Conduct on Data Centres Energy Efficiency, Version 5.1.1

1. Area of responsibility
   1. Which areas are the responsibility of your company:

|  | **Area of responsibility** | **Description** |
| --- | --- | --- |
|  | Building | The building including security, location and maintenance. |
|  | Mechanical and electrical plant | The selection, installation, configuration, maintenance and management of the mechanical and electrical plant. |
|  | Data center floor | The installation, configuration, maintenance and management of the main floor of a data center where the IT equipment is installed. |
|  | IT racks | The installation, configuration, maintenance and management of the IT racks housing the IT equipment. |
|  | IT equipment | The selection, installation, configuration, maintenance and management of the physical IT equipment. |
|  | Operating system/virtualization | The selection, installation, configuration, maintenance and management of the operating system and virtualization software installed on the IT equipment. This includes monitoring clients, hardware management agents, etc. |
|  | Software | The selection, installation, configuration, maintenance and management of the application software installed on the IT equipment. |
|  | Business practices | The determination and communication of the business requirements for the data center including the importance of the system, availability and maintenance requirements and data management processes. |

Source: EU Code of Conduct on Data Centres Energy Efficiency, Version 5.1.1

1. Is your data center required to maintain a minimum level of availability? (Is your data center infrastructure designed for a certain level of availability?) (Yes/No)

⇨ If Yes, what is the minimum level of availability that your data center must provide?

According to the security standard of tier classifications (Uptime Institute, USA)

Tier (1, 2, 3, 3+, 4) ⇨

According to the data center category from the matrix in the Planning Guide for a Reliable Data Center (BITKOM, https://www.bitkom.org/Bitkom/Publikationen/Betriebssicheres-Rechenzentrum.html)

Data center category (A – D) ⇨

According to TÜV IT level ⇨       (enter TÜV level)

In terms of percent ⇨       (enter %)

In terms of annual hours out of service ⇨       (enter hours)

## Installed nominal output of IT equipment

How high is the installed nominal output of the IT equipment based on the individual consumers and in accordance with the information published by the manufacturers (data sheets) at the measurement point MPIT2 in the following diagram?

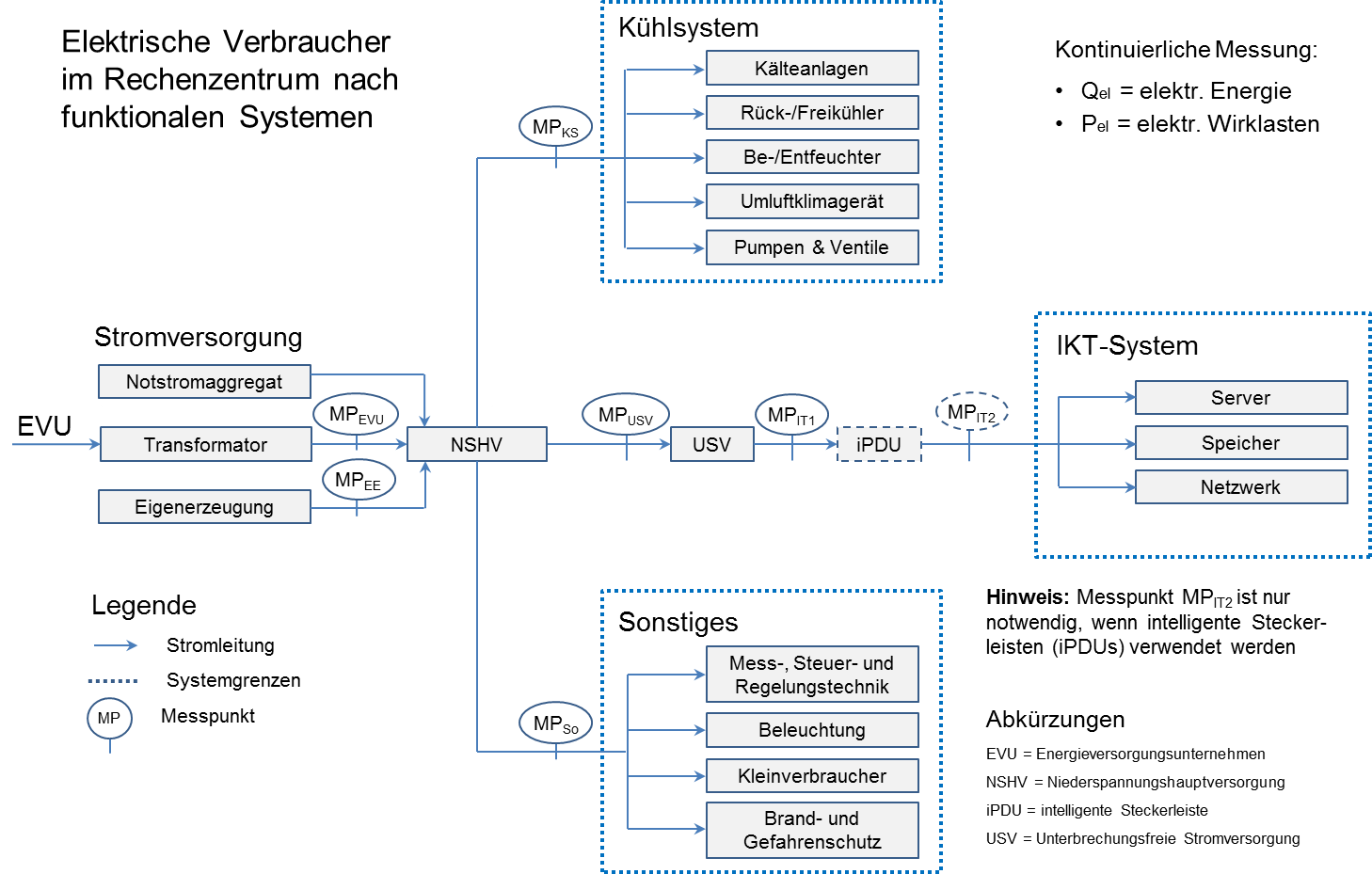


Figure 1: Measurement of the main components of a data center

|  |  |
| --- | --- |
| **IT components** | **Nominal output[[1]](#footnote-2)** |
| Servers | kWel |
| Storage | kWel |
| Network | kWel |

## Redundancy concepts

What redundancy concept has been implemented for the external power supplies for the IT components? (select in each case for the servers, storage systems and network equipment)

|  |  |  |  |
| --- | --- | --- | --- |
| **Redundancy concept** | **Servers** | **Storage systems** | **Network equipment** |
| **N** |  |  |  |
| **N+1** |  |  |  |
| **2N** |  |  |  |
| **2(N+1)** |  |  |  |
| **Other** |  |  |  |

## Servers and installed CPUs

1. Have the servers located in your data center been measured using the *SPEC Power*,  *SPEC SERT* or a comparable energy efficiency benchmark?

Yes: Designation of the benchmark:

No

1. Do the servers in your data center have an energy-saving mode installed? (Yes/No)

⇨ If Yes: Is the energy-saving mode used on the servers?

On some servers

On all servers

1. Do you use virtual servers in your data center? (Yes/No)

⇨ If Yes:

* 1. How many virtual servers do you use?
  2. How many physical servers do you use?
  3. What is the average degree of virtualization on the servers (number of virtual servers in relation to the total number of all physical servers in the data center)?

1. How many CPUs do you use in your data center?       (only enter the number of CPUs here, not the number of processor cores. A quad-core processor thus counts as one CPU.)
2. How many processor cores are operated in total?       (enter the number of all processor cores in the servers.)
3. Which CPU load average, ITEUSV, according to the ISO 30134-5 standard (Information technology – Data centres – Key performance indicators – Part 5: IT Equipment Utilization for servers (ITEUsv)) or an equivalent method, do the servers used in the data center achieve on average?  
          % (Minimum requirement 20 %)

## Data management / data backup / storage

What technology do you use to archive your data? (multiple answers are possible)

Hard drive storage systems

Tape library systems

Virtual tape library systems

Other:

# Part 2: Technical equipment and key figures

## Determining the Power Usage Effectiveness at the time of application

In order to determine the PUE value (Power Usage Effectiveness), a measurement concept must be implemented in the data center in accordance with “Appendix B: Measurement Concept” of the Basic Award Criteria.

The following table documents the values for the Power Usage Effectiveness (PUE) of the data center for the past 12 months at the time of application:

Table 3 Documentation of the calculation of the PUE (Power Usage Effectiveness)

|  |  |  |
| --- | --- | --- |
| **Measurement values and key figures** | | **Name of measurement point**  (see here also Figure 1 and Appendix B to the Basic Award Criteria) |
| Measurement period | From:  Until: |  |
| Annual electricity demand of the entire data center | MWh/a | Qel,DC,a = MPESC + MPOSG |
| Annual electricity demand of the IT equipment | MWh/a | Qel,IT,a = MPIT |
| Annual electricity demand of the cooling system | MWh/a | Qel,CS,a = MPCS |
| Annual electricity demand of the UPS systems (losses) | MWh/a | Qel,UPS\_losses,a = MPIT1 - MPUPS |
| Annual electricity demand of the PDUs (losses) | MWh/a | Qel,PDU\_losses,a = MPIT2 - MPIT1 |
| Annual electricity demand of other consumers | MWh/a | Qel,OC,a = MPOC |
| PUE |  |  |
| **In the event that the exemption is utilised, please mark the appropriate box with a cross:** | | |
| PUE value based on: | Planning data (enclosed as an appendix)  Load test (enclosed as an appendix) | |

**The following is valid for the continued use of this report as the “Energy Efficiency Report for final evaluation”:**

The annual values for the PUE and electricity demand are documented in Section 2.5.2 Monitoring electrical energy (monthly and annually).

## Electrical energy

1. The electricity used in the data center is provided via a third party[[2]](#footnote-3):

Yes (continue with 2.)

No (continue with 3.)

1. The electricity provided by the third party accounts for less than half of the total electricity supplied via the relevant electricity supply contract:

Yes (the exemption applies)

No (continue with 3.)

1. The electricity demand is covered 100% from renewable energies or from decentralised combined heat and power plants:

Yes

No

1. The specific global warming potential of the electricity mix based on the electricity labelling data according to Article 42 of the German Energy Act (Energiewirtschaftsgesetz) is       g of carbon dioxide equivalents per kilowatt hour of electricity.

In the event that the exemption is utilised, information in accordance with the exemption rule in Paragraph 3.1.1.4 of the Basic Award Criteria shall be enclosed as Annex 5 to the Contract and the plausibility of the documentation confirmed by the testing institution.

## Electrical switching systems

1. The following gas or the following technology is used as the insulating medium in the medium-voltage and low-voltage switching systems used in the data center:
2. The electrical switching systems are free of sulphur hexafluoride (SF6):

Yes (requirement for new acquisitions)

No

## IT inventory list

The IT components installed in the data center must be documented with the aid of an IT inventory list for servers, external storage systems and network equipment. For this purpose, the completed Excel spreadsheets a. *Servers,* b. *External Storage Systems and* c. *Network Equipment* (sheets 2a-c of the supplied Excel file) must be printed out and enclosed with the report as Annexes (2a-c).

**The following three subsections are valid for the continued use of this report as the “Energy Efficiency Report for final evaluation”:**

### Continued use of the IT inventory list

The IT inventory list is continuously updated. All changes to the servers, external storage systems and network equipment since the time of the application must be documented in this list. In the event of the new acquisition of Power Distribution Units (PDUs), these must also be documented with their technical data in Annex 2d. For this purpose, the updated Excel spreadsheets *a. Servers, b. External Storage Systems,* *c.* *Network Equipment* and *d.* *PDUs* (sheets 2a-d of the provided Excel file) must be printed out and enclosed with the report as Annexes (2a-d).

### Acquisition of new servers

Newly acquired servers must be added to the IT inventory list (Annex 2a). Their power consumption in an idle state (idle state power, Pidle) and their energy efficiency in an active state (Effactive) must be documented in the IT inventory list. In the event that the exemption is utilised, the deviation from the requirement according to the exemption rule must also be documented in the IT inventory list (Annex 2a).

### Acquisition of new energy efficient external power supplies

Newly acquired external power supplies and external power supplies built into newly acquired servers must be added to the IT inventory list for servers (Annex 2a). Compliance with the required energy efficiency standard (80 PLUS PLATINUM) must be documented in the list.

## Monitoring of the electrical energy and IT load

### Monitoring of the IT load

In order to monitor the IT load, the load average for the servers, RAM memory and storage systems must be continuously monitored based on a time series.

The following values must be documented at least monthly for the past 12 months or, in the case of data centers that were commissioned less than 12 months ago, from the time the data center was commissioned:

* Load average for the CPUs [%]
* Load average for the storage [%]
* Data transmissions for external network connections [Gbit/a]

The calculation of the load average must be carried out based on the method described in “Appendix D: Calculation of the load average of the IT equipment” of the Basic Award Criteria.

This is documented in the supplied Excel file in the worksheet 2f\_IT\_Monitoring, which should be printed out and enclosed with this report as Annex 2f.

**The following is valid for the continued use of this report as the “Energy Efficiency Report for final evaluation”:**

### Monitoring electrical energy (monthly and annually)

#### Monthly energy monitoring

In addition to the values for the IT load required under 2.5.1, the Energy Efficiency Report shall also document the following monthly values for the past 12 months (see Appendix B: Measurement Concept of the Basic Award Criteria):

* Electricity demand of the entire DC (MPESC + MPOSG) [kWhel]
* Electricity demand of the IT equipment (MPIT2) [kWhel]
* Electricity demand of the cooling system (MPCS) [kWhel]
* Electricity demand of the UPS (losses) (MPUPS - MPIT1) [kWhel]
* Electricity demand of other consumers (MPOC) [kWhel]
* Cooling load of the entire DC [kWhth]

This is documented in the supplied Excel file, which should be printed out and enclosed with this report as Annex 2e (Energy Monitoring).

#### Annual monitoring

The following results of the monitoring shall be documented annually based on the time series stated in the following table:

* Electricity demand entire DC
* Electricity demand IT equipment
* PUE
* EER

Documentation of the most important results of the annual energy monitoring

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **Electricity  demand entire DC** | **Electricity demand  IT equipment** | **PUE** | **EER** |
| Year 0 (application) | MWhel/a | MWhel/a |  |  |
| Year 1 | MWhel/a | MWhel/a |  |  |
| Year 2 | MWhel/a | MWhel/a |  |  |
| ... Year n | MWhel/a | MWhel/a |  |  |

## Cooling system

### General information on the cooling system

1. What type of air conditioning system is used for the IT technology in the server room? (please select from the following options, multiple answers are possible):
   1. The air in the server room is climate controlled (air conditioning of the server room): (Yes/No).

⇨ If Yes, please state how the server room is air conditioned:

The server room is air conditioned using only a recirculation cooler.

The server room is air conditioned using only a direct evaporator (split system).

Both: The server room is air conditioned using a direct evaporator and a recirculation cooler.

Other:

* 1. Individual racks are directly/additionally air conditioned: (Yes/No)
  2. Both: Individual racks and the entire server room are air conditioned:  
         (Yes/No)
  3. Other (please specify e.g. “direct free cooling with outside air” or “direct CPU cooling”):
  4. What is the temperature of the supply air? (at the recirculation cooler      °C and/or the direct evaporator      °C and/or the inlet system     °C)
  5. What is the temperature of the exhaust air? (at the recirculation cooler      °C and/or the direct evaporator      °C and/or the inlet system     °C)
  6. Please enter information below for every recirculation cooler or direct evaporator in the data center:

For recirculation coolers:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sequential number** |  |  |  |  |
| Number of systems of this type |  |  |  |  |
| Manufacturer |  |  |  |  |
| Model name |  |  |  |  |
| Nominal power output (kWel) |  |  |  |  |
| Nominal power output (kWth) |  |  |  |  |
| Design temperature[[3]](#footnote-4) exhaust air (°C) |  |  |  |  |
| Design temperature supply air (°C) |  |  |  |  |
| Max. volumetric flow rate under design conditions (m³/h) |  |  |  |  |
| Is the speed of the fan controllable? (Yes/No) |  |  |  |  |

For direct evaporators (split units):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sequential number** |  |  |  |  |
| Date commissioned |  |  |  |  |
| Number of systems of this type |  |  |  |  |
| Manufacturer |  |  |  |  |
| Model name |  |  |  |  |
| Nominal power output (kWel) |  |  |  |  |
| Nominal power output (kWth) |  |  |  |  |
| Design temperature (exhaust air in °C) |  |  |  |  |
| Design temperature (supply air in °C) |  |  |  |  |
| Max. volumetric flow rate under design conditions (m3/h) |  |  |  |  |
| Is the speed of the fan controllable? (Yes/No) |  |  |  |  |
| Refrigerant used |  |  |  |  |
| Quantity of refrigerant used |  |  |  |  |
| EER/  COP of the system |  |  |  |  |

* 1. How is the air supplied to the server room/ICT room?

Via a raised floor

Via a ceiling outlet

Via inlet systems between the racks

Other:

* 1. Do you completely separate cold and warm air? (Yes/No)

⇨ If Yes, please select:

The racks are arranged according to the hot aisle / cold isle configuration but with no containment.

The racks are arranged according to the hot aisle / cold isle configuration and the relevant aisles are fully contained.

Other:

* 1. What redundancy is provided for the recirculation cooler and/or direct evaporator and/or inlet system?

|  |  |  |  |
| --- | --- | --- | --- |
| **Redundancy concept** | **Recirculation cooler** | **Direct evaporator** | **Inlet system** |
| **N** |  |  |  |
| **N+1** |  |  |  |
| **2N** |  |  |  |
| **2(N+1)** |  |  |  |
| **Other** |  |  |  |

* 1. Do you use air cooling to cool the racks? (Yes/No)

⇨ If Yes: Please enter the design temperature of the:

Supply air entering the recirculation cooler/direct evaporator:

Exhaust air entering the recirculation cooler/direct evaporator:

* 1. What refrigerant (liquid heat transfer medium, not air) do you use for rack cooling?

Water

Another refrigerant:

* 1. What type of rack cooling system do you use?

Central refrigerant-based system

⇨ Please state the supply temperature of the refrigerant (inlet temperature of the refrigerant in the recirculation cooler/direct evaporator/inlet system):      °C

⇨ Please state the return temperature of the refrigerant (outlet temperature of the refrigerant in the recirculation cooler/direct evaporator/inlet system):      °C

Decentralised system

⇨ Please briefly describe your decentralised cooling system:

1. Please enter information below for every pump type in your data center:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sequential number** |  |  |  |  |
| Number of pumps of this type |  |  |  |  |
| Manufacturer |  |  |  |  |
| Model name |  |  |  |  |
| Nominal power output (kWel) |  |  |  |  |
| Controllable speed? (Yes/No) |  |  |  |  |
| Redundancy concept (N, N+1, 2N, 2(N+1), other) |  |  |  |  |

1. Please enter information below on the humidity in your data center:
   1. What is the minimum permissible humidity (in %)?       %
   2. What is the maximum permissible humidity (in %)?       %
   3. Is moisture-sensitive equipment (e.g. storage systems) kept in a different room? (Yes/No)
2. Do you use the principle of free cooling at your data center?      (Yes / No).

⇨ If Yes:

Indirect free cooling:

⇨ Standard indirect free cooling at outside temperatures below or equal to      °C.

⇨ Hybrid[[4]](#footnote-5) indirect free cooling at outside temperatures below or equal to      °C.

Direct free cooling:

⇨ Standard direct free cooling at outside temperatures below or equal to      °C.

⇨ Hybrid direct free cooling at outside temperatures below or equal to      °C.

* 1. Please enter information below for every type of free cooling in your data center:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sequential number** |  |  |  |  |
| Method (direct/indirect free cooling) |  |  |  |  |
| Type (only for indirect free cooling)[[5]](#footnote-6) |  |  |  |  |
| Number of systems of this type |  |  |  |  |
| Manufacturer |  |  |  |  |
| Model name |  |  |  |  |
| Nominal electrical output (kWel) |  |  |  |  |
| Cooling performance (nominal power output) (kWth) |  |  |  |  |

1. Do you use theheat from the data center (e.g. for heating offices)?      (Yes/No)
2. What redundancy concept do you use for the cooling systems?

N

N+1

2N

2(N+1)

Other redundancy concept:

1. Please enter information below for every type of cooling system in your data center:

For compression-type chillers:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sequential number** |  |  |  |  |
| Date commissioned |  |  |  |  |
| Type (e.g. compression system) |  |  |  |  |
| Number of systems of this type |  |  |  |  |
| Manufacturer |  |  |  |  |
| Model name |  |  |  |  |
| Nominal electrical output (kWel) |  |  |  |  |
| Cooling performance (nominal power output) (kWth) |  |  |  |  |
| Design temperature[[6]](#footnote-7) flow (°C) |  |  |  |  |
| Design temperature return (°C) |  |  |  |  |
| Refrigerant used |  |  |  |  |
| Quantity of refrigerant used |  |  |  |  |
| EER/  COP of the system |  |  |  |  |

For absorption chillers:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sequential number** |  |  |  |  |
| Date commissioned |  |  |  |  |
| Type (e.g. absorption or adsorption chillers) |  |  |  |  |
| Number of systems of this type |  |  |  |  |
| Manufacturer |  |  |  |  |
| Model name |  |  |  |  |
| Cooling performance (nominal power output) (kWth) |  |  |  |  |
| Therm. drive power (nominal power output) (kWth) |  |  |  |  |
| Nominal electrical output (kWel) |  |  |  |  |
| Design temperature flow (°C) |  |  |  |  |
| Design temperature return (°C) |  |  |  |  |
| Refrigerant used |  |  |  |  |
| Quantity of refrigerant used |  |  |  |  |
| Level (Effect: Single/Double/Triple) |  |  |  |  |
| Heat capacity of the system |  |  |  |  |
| therm.  SEER or  EER of the system |  |  |  |  |

**The following is valid for the continued use of this report as the “Energy Efficiency Report for final evaluation”:**

Newly installed cooling systems must be added to the previous table.

In the event that the exemption for the use of refrigerants containing halogens with a maximum cooling requirement of 50 kWth is utilised, this is justified for the following reason:

1. Please provide the flow and return temperature for the cold water circuit (or refrigerant circuit for a different refrigerant that is not air):

Flow temperature:      °C

Return temperature:      °C

1. Please provide the average annual temperature or the postal code for the location of the data center:      °C Postal code:

### Energy efficiency of the cooling system (calculation of the energy efficiency ratio)

In cooling systems that are operated by means of electrically operated compression-type chillers, the energy efficiency ratio must be determined by measurements carried out at the required measurement points in accordance with “Appendix B: Measurement Concept” of the Basic Award Criteria.

In the event that the exemption is utilised, please document the EER and, where relevant, the basis for the calculation of the EER value in accordance with the exemption rule in Table 4. The planning data, measurement report for the load tests (Exemption 1) and, where relevant, the calculation of the corresponding performance values or the specific greenhouse gas emissions (Basic Award Criteria, Paragraph 3.1.1.2, Exemption 2) are enclosed with this report as an appendix. The plausibility of this documentation must be examined and confirmed by the auditor.

Table 4 Documentation of the calculation of the energy efficiency ratio (EER)

|  |  |
| --- | --- |
| **Energy consumption in the past 12 months** | |
| Cooling load:  Qth,DC,a | (kWhth/a)  (calculated in accordance with VDI Guideline 2078) |
| Energy demand of the cooling system (please mark the relevant box with a cross and provide the corresponding value, see exemption rule): | |
| Electric cooling system (Qel,DC,a) | (kWhel/a) |
| Non-electric cooling system (Qel,DC,a) | (kWhel/a)  Alternative calculation of FATC enclosed as an appendix |
| EER | (kWhth/kWhel) |
| **For Exemption 1** (cooling system commissioned less than twelve months ago ) **please also mark the relevant box with a cross:** | |
| EER value based on: | Planning data (enclosed as an appendix)  Load test (enclosed as an appendix) |

1. Do you use an absorption chiller in the cooling system? (Yes/No)

⇨ If Yes, please complete Table 5 and enclose the calculation of the specific greenhouse gas emissions for a cooling system with an absorption chiller (FATC) and a comparative calculation for a cooling system with a compression-type chiller (FCTC) as an appendix.

Table 5 Calculation of the specific greenhouse gas emissions FATC and FCTC

|  |  |
| --- | --- |
| **For Exemption 2** (absorption chiller)**:** | |
| Specific greenhouse gas emissions for a cooling system with an absorption chiller (FATC) | (kgCO2/kWhth) |
| Specific greenhouse gas emissions for a comparative system with a compression-type chiller (FCTC) | (kgCO2/kWhth) |
| Is the requirement FATC ≤ FCTC  fulfilled? | (Yes/No) |

## Uninterruptible Power Supply (UPS)

1. Do you use a UPS in your data center? (Yes/No)

⇨ If Yes:

Please indicate which area(s) of the data center are secured by the UPS (multiple answers possible):

ICT components

Fans in the server room (e.g. recirculation cooler, inlet systems)

Pumps in the cooling circuit

Other

1. What technical concept do you use for the UPS?

Online double conversion

Online delta conversion

Standby operation using flywheel technology

Standby operation using battery technology (dynamic UPS)

UPS for linear standby operation

Other

1. What redundancy concept have you implemented for the UPS?

N (no redundancy)

N+1

2N

2(N+1)

Other

1. Please complete the following table for existing and newly acquired uninterruptible power supply (UPS) systems.

Table 6 Documentation of the efficiency of the UPS systems

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sequential number** |  |  |  |  |
| Type |  |  |  |  |
| Number of systems of this type |  |  |  |  |
| Manufacturer |  |  |  |  |
| Model name |  |  |  |  |
| Power factor (cos phi) |  |  |  |  |
| Nominal power output (kVA) |  |  |  |  |
| Efficiency at 25% nominal output |  |  |  |  |
| Efficiency at 50% nominal output |  |  |  |  |
| Efficiency at 75% nominal output |  |  |  |  |
| Efficiency at 100% nominal output |  |  |  |  |

**The following is valid for the continued use of this report as the “Energy Efficiency Report for final evaluation”:**

Newly acquired uninterruptible power supply (UPS) systems must be added to the previous table.

# Glossary

**COP**: Coefficient of Performance: A performance value for mechanical [cooling systems](http://de.wikipedia.org/wiki/Kälteanlagen) and for mechanical [heat pumps](http://de.wikipedia.org/wiki/Wärmepumpe). It is the ratio between the heating or cooling provided and the electrical energy consumed.

**CPU:** A Central Processing Unit (CPU) is the central component of a computer.

**Direct evaporator:** An air conditioning device that has an outdoor unit split by separate outdoor and indoor units (condenser and evaporator). Another name for this type of system is a split system.

**EER:** The energy efficiency ratio is a dimensionless key figure that describes the energy efficiency of a system. In the case of mechanical cooling systems, it is the ratio between the generated thermal energy (cold) to the electrical energy used over a defined period of time. If the EER is recorded over a time period of one year then it corresponds to the annual energy efficiency ratio (EER) of the cooling system.

**IT:** Information technology (IT) is an umbrella term for the hardware and software used for data processing.

**Annual EER:** The annual energy efficiency ratio (EER) is the ratio of the cooling output over a time period of one year to the input electrical energy. If the EER is not calculated for an individual chiller but instead for the entire cooling system, the cooling output by free cooling (generally through outside air) will be included in the calculation on the cooling side. Similarly, the electrical energy used to power the fans and pumps responsible for cooling distribution are included.

**CS:** A cooling system is the sum of the technical facilities for cooling a building or individual rooms e.g. a data center.

**CWC:** A cold water chiller (CWC) is a chiller that cools a fluid heat transfer medium.

**PDU:** A Power Distribution Unit (PDU) is the distribution unit within a server room that distributes the low voltage electricity to the individual IT components.

**DC:** A data center is a spatially confined technical facility that serves to securely, permanently and centrally process large amounts of data over a long period of time.

**SPEC Power Benchmark**: Measurement value for the energy efficiency of a server

**Recirculation cooler:** A cooling device that circulates the air to be cooled in a circuit, i.e. no outside air is supplied, and this is cooled using heat transfer to the desired temperature level.

**UPS:** An Uninterruptible Power Supply (UPS) 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 servers and storage systems can be properly shut down in the event of a prolonged power failure.

# Overview of the annexes to the contract

**Obligatory annexes to the contract for the Energy Efficiency Report for applications in accordance with Paragraph 3.1.3 of the Basic Award Criteria**

**Annex 2a** IT Inventory List for Servers  
(Printed form from EXCEL table, sheet 2a\_Servers)

**Annex 2b** IT Inventory List for External Storage Systems   
(Printed form from EXCEL table, sheet 2b\_External Storage Systems)

**Annex 2c** IT Inventory List for Network Equipment  
(Printed form from EXCEL table, sheet 2c\_Network Equipment)

**Annex 2e** Energy Monitoring  
(Printed form from EXCEL table, sheet 2e\_Energy Monitoring)

**Annex 2f** Monitoring of the IT load  
(Printed form from EXCEL table, sheet 2f\_Monitoring of the IT load)

**Annex 4**: Report from an auditor about the completeness and plausibility of the Energy Efficiency Report at the time of application (Annex 2) in accordance with Paragraph 3.1.3 “Energy Efficiency Report at the time of application” of the Basic Award Criteria

**Annex 5**: Electricity labelling data according to Article 42 of the German Energy Act (Energiewirtschaftsgesetz) or individual verification of the specific greenhouse gas emissions, or justification for exemption from Paragraph 3.1.1.4 “Electrical energy” of the Basic Award Criteria

**Obligatory annexes to the contract for the Energy Efficiency Report for final evaluation in accordance with Paragraph 3.2.3 of the Basic Award Criteria**

**Annex 2a** Continued use of the IT Inventory List for Servers  
(Printed form from EXCEL table, sheet 2a\_Servers)

**Annex 2b** Continued use of the IT Inventory List for External Storage Systems   
(Printed form from EXCEL table, sheet 2b\_External Storage Systems)

**Annex 2c** Continued use of the IT Inventory List for Network Equipment  
(Printed form from EXCEL table, sheet 2c\_Network Equipment)

**Annex 2d** Continued use of the IT Inventory List for the Acquisition of New Intelligent PDUs  
(Printed form from EXCEL table, sheet 2d\_PDUs)

**Annex 2e** Continued use of the Energy Monitoring  
(Printed form from EXCEL table, sheet 2e\_Energy Monitoring)

**Annex 2f** Continued use of the Monitoring of the IT load  
(Printed form from EXCEL table, sheet 2f\_Monitoring of the IT load)

**Optional annexes to the Energy Efficiency Report, if exemptions have been utilised:**

**Appendix to Section 2.1**: Calculation of the PUE value on the basis of planning data or a load test in accordance with Paragraph 3.1.1.1 “Power Usage Effectiveness” of the Basic Award Criteria

**Appendix to Section 2.6.2**: Calculation of the energy efficiency ratio (EER) on the basis of planning data or a load test in accordance with Exemption 1 to Paragraph 3.1.1.2 “Energy efficiency of the cooling system” of the Basic Award Criteria

**Appendix to Section 2.6.2**: Calculation of the specific greenhouse gas emissions for a cooling system with an absorption chiller (FATC) and a comparative calculation for a cooling system with a compression-type chiller (FCTC) in accordance with Exemption 2 to Paragraph 3.1.1.2 “Energy efficiency of the cooling system” of the Basic Award Criteria

1. In the case of redundant external power supplies, the nominal output is the output of the individual external power supply [↑](#footnote-ref-2)
2. e.g. the operator of an administration building or a superordinate administrative unit of an authority or company [↑](#footnote-ref-3)
3. The design temperature describes the temperatures of the supply and exhaust air that were recorded for the nominal thermal output. [↑](#footnote-ref-4)
4. Hybrid cooling is understood to mean a combination of multiple cooling systems with different heat transfer mediums (generally air and water) [↑](#footnote-ref-5)
5. The following types of indirect free cooling are used: dry, hybrid or wet [↑](#footnote-ref-6)
6. The design temperature describes the return and flow temperatures of the water chiller that were recorded for the thermal cooling capacity stated by the manufacturer (rated output). [↑](#footnote-ref-7)