

The European Commission's science and knowledge service

Joint Research Centre

EU GPP criteria for DATA CENTRES

2nd Ad Hoc Working Group
Meeting

29th - 30th May 2018



European
Commission

Agenda for the webinars

Day one

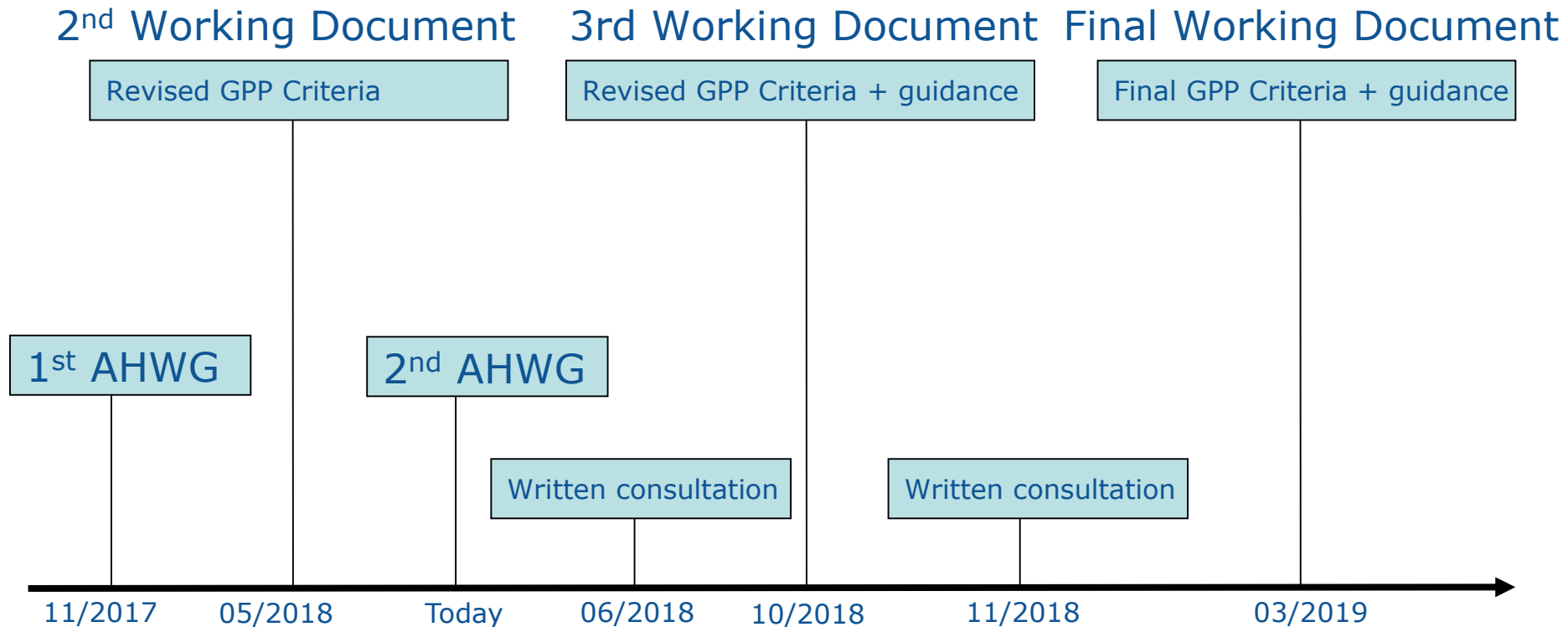
1	Introduction and background Work programme, timeline and stakeholder engagement process.
2	Scope and overview of the criteria Presentation and discussion on scope modification and restructured criteria proposal
3	Criteria Area 1: IT System Performance, The key issues proposed to be addressed, second GPP proposals.
4	Criteria Area 2: M&E System Performance, The key issues proposed to be addressed, second GPP proposals.

Agenda for the webinars

Day two

5	Criteria Area 2: M&E System Performance (<i>continued from day 1</i>) The key issues proposed to be addressed, second GPP proposals.
6	Criteria Area 3: System Level Performance – presentation and discussion The key issues proposed to be addressed, second GPP proposals.
7	Procurement Practice Guidance for Data Centers Outline of the proposal and call for involvement/case studies.

Work Programme and Timeline



Publication of the technical background documents and second criteria proposals

Criteria and metrics to be included in the GPP criteria

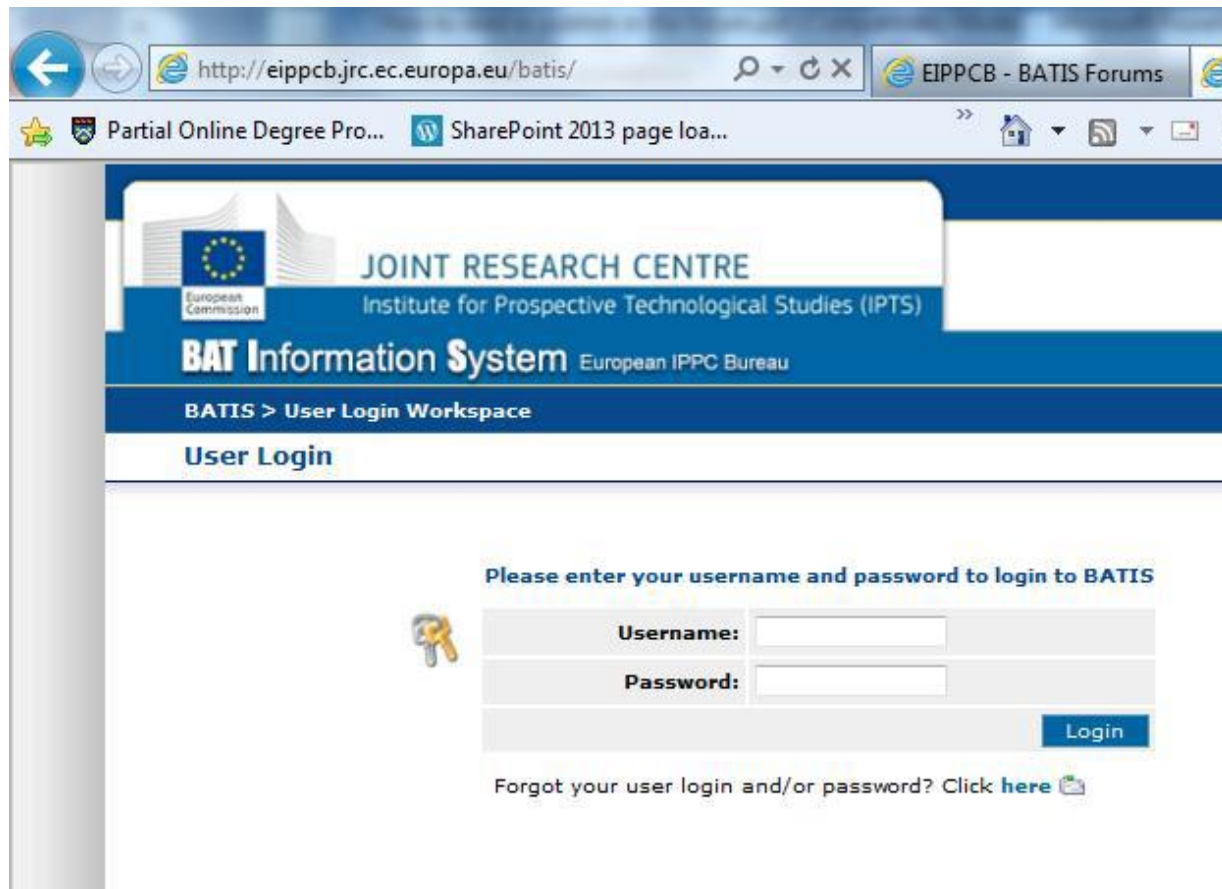
Date	Description	Link
10/05/2018	Overview of first draft criteria proposals (v2.0)	Overview v2.0
10/05/2018	Technical Background Report with first draft criteria proposals (v2.0)	Technical report v2.0

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Comments using the BATIS system

Written comments on the first criteria proposals are invited and should be posted on the BATIS system **at the latest by Wednesday 27th June 2018**



The screenshot shows a web browser window with the URL <http://eippcb.jrc.ec.europa.eu/batis/>. The browser's address bar also shows "EIPPCB - BATIS Forums". The page features the European Commission logo and the text "JOINT RESEARCH CENTRE Institute for Prospective Technological Studies (IPTS)". Below this, it says "BAT Information System European IPPC Bureau". The main heading is "BATIS > User Login Workspace" followed by "User Login". A key icon is next to the login instructions: "Please enter your username and password to login to BATIS". There are two input fields: "Username:" and "Password:". A "Login" button is to the right of the password field. At the bottom, it says "Forgot your user login and/or password? Click [here](#)".

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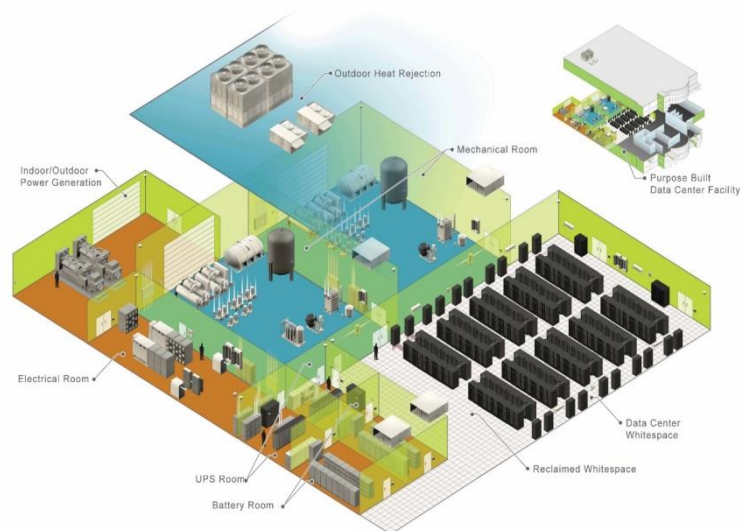
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Scope modification and overview of the criteria

29th May 2018



Scope Definition



Data centre and server rooms definition

Data centres means structures, or group of structures, dedicated to the centralised accommodation, interconnection and operation of information technology and network telecommunications equipment providing data storage, processing and transport services together with all the facilities and infrastructures for power distribution and environmental control, together with the necessary levels of resilience and security required to provide the desired service availability. This definition includes server rooms (see Table 2).

Server rooms referred to also as computer rooms or server closets, are rooms or portions of a building serving an IT load less than or equal to 10 kW. Server rooms have usually IT control and may have some dedicated power and cooling capabilities. Server rooms are enterprise data centres but in a smaller scale, usually housed in an area indicatively less than 46m² based on an assumption of a power density of 215 W/m².

Reasons for the modification

- According to EURECA, 80% of the data centres found in 360 public institutions in Ireland, the UK and the Netherlands are less than 25 racks
- It means around 50m² and 10 kW of IT load (server rooms as portion of a building)
- Large improvement opportunities come from SERVER ROOMS



Reference classifications

Type of data centre	Description	Size (m ²)	Number of servers	IT workload
Server closet	No external storage; typically use a common HVAC ⁴⁷ system; room within an office building	<18.6	1-2	Up to 10 kW
Server room	No external storage; typically common HVAC with additional cooling capacity	<46.4	10-100	Up to 10 kW
Localized data centre	Moderate external storage; typically dedicated HVAC system; a few CRAC ⁴⁸ units with fixed speed fans	<92.9	100-1 000	Up to 30 kW
Mid-tier data centre	Extensive external storage; typically under floor air distribution and CRAC units with variable speed fans	<464.5	1 000-10 000	Typically between 30 and 500 kW
Enterprise class data centre	Extensive external storage; most efficient cooling along with energy and airflow management systems	>464.5	>10 000	>500 kW

Source: EMAS BEMP (2016)

Data Centre classification

Product group type	Definition
Enterprise data centre	A data centre which has the sole purpose of the delivery and management of services to its employees and customers and that is operated by an enterprise ¹² .
Colocation data centre	A data centre facility in which multiple customers locate their own network(s), servers and storage equipment ¹³ .
Managed Service Providers (MSP) data centre	Server and data storage services where the customer pays for a service and the vendor provides and manages required IT hardware/software and data centre equipment. This includes the co-hosting of multiple customers, which may take the form of a cloud application environment. Generic providers are those offering non-proprietary applications (such as Hosted Exchange) while specialized providers offer proprietary applications (such as G Suite).

Data Centre and Server Rooms scope

Proposed data centres and server rooms criteria scope

For the purposes of this GPP criteria set the scope shall encompass performance aspects of:

- The IT equipment and associated network connections that carry out the primary function of the datacentre, including the servers, storage and network equipment;
- The Mechanical & Electrical equipment used to regulate and condition the power supply (transformers, UPS) and the mechanical systems to be used to regulate the environmental conditions (CRAC/CRAH) in the white space¹⁴;
- Data centre systems as a whole or a managed data centre service.

The building fabric (i.e. physical structure of the building and its respective building materials) is not included in the proposed scope.

Definition and Scope

Discussion points

- Extension to include [server rooms](#)
- Applicability and relevance of criteria to [cloud services?](#)

Overview of the criteria

CRITERIA AREA 1: IT SYSTEM PERFORMANCE

IT system design and/or operation which significantly affect its environmental performance.

CRITERIA AREA 2: MECHANICAL & ELECTRICAL SYSTEMS PERFORMANCE

System and equipment relating to the electrical supply and distribution to support IT loads and thermal operation of a data centre.

CRITERIA AREA 3: DATA CENTRE PERFORMANCE

Whole system design and/or operation which affect its environmental performance.

Criteria Area 1: IT System Performance

CRITERIA AREA	CRITERIA PROPOSAL	
IT System Performance	Server energy efficiency	
	IT equipment utilisation	
	Material Efficiency Criteria	Refresh Rate
		Design for disassembly and repair
		End of life management
		Emissions of hazardous substances – restricted substance controls in servers
		ICT Operating Range – Higher temperature hardware

Criteria Area 2: Mechanical and Electrical System Performance

CRITERIA AREA	CRITERIA PROPOSAL	
M&E System Performance	Power Utilisation Effectiveness (PUE)	
	Reuse of waste heat	
	Cooling systems best practices	Airflow Management
		Cooling Plant
		Air Conditioning / Air Handling

Criteria Area 3: Data Centre Performance

CRITERIA AREA	CRITERIA PROPOSAL
Data Centre Performance	Renewable Energy Factor
	Use of refrigerants and their Global Warming Potential

Types of GPP Criteria

- **Selection criteria (SC)** assess the suitability of an economic operator to carry out a contract
- **Technical specifications (TS)**, the required characteristics of a product or a service including requirements relevant to the product at any stage of the life cycle of the supply or service and conformity assessment procedures;
- **Award criteria (AC)**, qualitative criteria with a weighted scoring which are chosen to determine the most economically advantageous tender
- **Contract performance clauses (CPC)**, special conditions laid down that relate to the performance of a contract and how it shall be carried out and monitored

Two ambition levels

The **Core criteria** are designed to allow for easy application of GPP, focussing on the key area(s) of environmental performance of a product and aimed at keeping administrative costs for companies to a minimum.

The **Comprehensive criteria** take into account more aspects or higher levels of environmental performance, for use by authorities that want to go further in supporting environmental and innovation goals.

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Criteria Area 1: IT System Performance

29th May 2018



Criterion 1.1: Server efficiency

1st criteria proposal

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATIONS	
<p>TS2.1 Server energy efficiency</p> <p>Servers shall meet the energy efficiency requirements of the latest version of the ENERGY STAR standard</p> <p>The version in force at the time of publication is 2.0 and updates can be followed at this weblink:</p> <p>http://www.eu-energystar.org/specifications.htm</p> <p>Annex III of Directive 2012/27/EU on energy efficiency, requires that servers purchased by central government shall meet the latest EU version of ENERGY STAR.</p> <p>Verification:</p> <p>The tenderer shall detail the server models supplied and corresponding test reports carried out according to the test methods laid down in the latest version of the ENERGY STAR. These shall be provided upon award of the contract or prior to that upon request.</p> <p>Upon request the contracting authority shall be provided with access to the equipment once on-site at the data centre for auditing purposes.</p> <p>Models that have qualified for EU ENERGY STAR and are registered on the programme's database shall be deemed to comply. ENERGY STAR registrations under the latest version in the USA shall also be accepted provided that testing according to European input power requirements has been carried out.</p>	<p>TS2.1 Server energy efficiency</p> <p>Servers shall meet the energy efficiency requirements of the latest version of the ENERGY STAR standard.</p> <p>The version in force at the time of publication is 2.0 and updates can be followed at this weblink:</p> <p>http://www.eu-energystar.org/specifications.htm</p> <p>Annex III of Directive 2012/27/EU on energy efficiency, requires that servers purchased by central government shall meet the latest EU version of ENERGY STAR.</p> <p>Verification:</p> <p>The tenderer shall detail the server models supplied and corresponding test reports carried out according to the test methods laid down in the latest version of the ENERGY STAR. These shall be provided upon award of the contract or prior to that upon request.</p> <p>Upon request the contracting authority shall be provided with access to the equipment once on-site at the data centre for auditing purposes.</p> <p>Models that have qualified for EU ENERGY STAR and are registered on the programme's database shall be deemed to comply. ENERGY STAR registrations under the latest version in the USA shall also be accepted provided that testing according to European input power requirements has been carried out.</p>

Criterion 1.1: Server efficiency

1st criteria proposal

AWARD CRITERIA	
<p>AC2.1. Improvement in the energy consumption upon the Energy Star active efficiency</p> <p><i>It is recommended to use this criterion in conjunction with TS2.1.</i></p> <p><i>* Please see the Explanatory note for further information.</i></p> <p>Points will be awarded If the product is more energy efficient than the threshold laid down in the latest version of the ENERGY STAR for servers.</p> <p>The energy efficiency value shall be calculated according to the test methods laid down in the latest version of the ENERGY STAR.</p> <p>Maximum points shall be awarded to the offer with the highest performance. All other offers shall be awarded points in proportion to the best offer.</p> <p>Verification:</p> <p>The tenderer shall detail the server models supplied and corresponding test reports carried out according to the test methods laid down in the latest version of the ENERGY STAR. These shall be provided upon award of the contract or prior to that upon request.</p> <p>Upon request the contracting authority shall be provided with access to the equipment once on-site at the data centre for auditing purposes.</p>	<p>AC2.1. Improvement in the energy consumption upon the Energy Star active efficiency</p> <p><i>It is recommended to use this criterion in conjunction with TS2.1.</i></p> <p><i>* Please see the Explanatory note for further information.</i></p> <p>Points will be awarded If the product is more energy efficient than the threshold laid down in the latest version of the ENERGY STAR for servers.</p> <p>The energy efficiency value shall be calculated according to the test methods laid down in the latest version of the ENERGY STAR.</p> <p>Maximum points shall be awarded to the offer with the highest performance. All other offers shall be awarded points in proportion to the best offer.</p> <p>Verification:</p> <p>The tenderer shall detail the server models supplied and corresponding test reports carried out according to the test methods laid down in the latest version of the ENERGY STAR. These shall be provided upon award of the contract or prior to that upon request.</p> <p>Upon request the contracting authority shall be provided with access to the equipment once on-site at the data centre for auditing purposes.</p>
EXPLANATORY NOTE	
<p>The current ENERGY STAR v2 doesn't have a metric for active efficiency. Instead it gives 12 worklet efficiencies, and these are not derived using the same calculation method as proposed for the new SERT methodology. The award criteria for active efficiency only works when verification is based on Energy Star Version 3 and following versions which will be based on the new SERT methodology and includes a specific metric on active efficiency.</p>	

Criterion 1.1: Server efficiency

Stakeholder comments

- Concern expressed that **Energy Star**, particularly in terms of idle power, does not reflect 'real' energy consumption and would not minimise energy use, and that **active efficiency** benchmarks had yet to be developed.
- Some confusion around the use of **SERT**, the **SEEM method** and the **active efficiency metric**
- The power used is also dependent on the **configuration** of the servers
- The influence of **software** on the efficiency and the importance of criteria addressing not just hardware.
- KPI proposed that enables the **total 'deployed' power** consumed by the server fleet to deliver the workload required to be estimated

Criterion 1.1: Server efficiency

Background research and follow-up

- **SERT test method** measures:
 - ✓ Active efficiency and performance under 12 different worklets, for three subsystems, generally >25% utilisation
- A metric is required to help interpret and evaluate **server active efficiency** - also referred to as **SEEM**:
 - ✓ based on the geometric mean of the SERT v2 worklet test results
 - ✓ Basis for draft EN 303 470:2018 (under development by ETSI)
- **Ecodesign Implementing Measure** draft proposal:
 - ✓ Idle power MEPS (Minimum Energy Performance Standard) based on allowances
 - ✓ Information requirement to report active efficiency result, indicative thresholds for BAT servers also provided
- **Energy Star v3.0** draft 1 criteria propose:
 - ✓ Active State efficiency score ($\text{Eff}_{\text{ACTIVE}}$) thresholds for different server types.

Criterion 1.1: Server efficiency

Minimum active efficiency

Minimum Server Efficiency (Draft ENERGY STAR v.3.0)	
<i>One Installed Processor</i>	
Rack	11.0
Tower	9.4
Blade or Multi-Node	9.0
Resilient	4.8
<i>Two Installed Processors</i>	
Rack	13.0
Tower	12.0
Blade or Multi-Node	14.0
Resilient	5.2
<i>Greater Than Two Installed Processors</i>	
Rack	16.0
Blade or Multi-Node	9.6
Resilient	4.2

Server Efficiency benchmarks (Draft Ecodesign regulation)	
Tower server, 1 socket	10
Rack server, 1 socket	9
Rack server, 2 socket, low performance	11
Rack server, 2 socket, high performance	20
Rack server, 4 socket	No available data
Blade server, 2 socket	15
Blade server, 4 socket	No available data
Resilient server, 2 socket	No available data

Criterion 1.1: Server efficiency

Background research and follow-up

- The estimated energy consumed by the fleet of servers is called the **deployment power**, generally based on:
 - ✓ the number of servers needed
 - ✓ the server configuration
 - ✓ The utilisation rate
- **Draft EN 303 470:2018** provides a method for calculating and estimating deployment power
- A **higher active efficiency** will indicate a lower active deployment power for an 'average' workload.
- If the aim is to predict the anticipated workloads under a contract as accurately as possible '**workload traces**' would be required.
 - ✓ Requires development by the public authority for each individual call for tender before contracting.

Criterion 1.1: Server efficiency

Discussion points

- Use of [Energy Star v.3.0 active efficiency thresholds](#) as the basis for the technical specification
- Linking use of the [idle power](#) and [active efficiency criteria](#) to the utilisation rate
- Verification based on the [EN 303470](#) measurement methodology (under development)
- Estimation and then monitoring of the [data centre IT electricity consumption](#) (deployed power)

Criterion 1.2: Equipment Utilization

1st Criteria Proposal

Core criteria	Comprehensive criteria
AWARD CRITERIA	
	<p>AC2.2 IT equipment utilisation</p> <p><i>Selection criteria shall be also applied to managed services in order to ensure that capacity to deliver high utilisation rates based on historical performance is evidenced.</i></p> <p>Points will be awarded based on the anticipated average utilisation rate for the IT equipment [or servers].</p> <p>Points shall be awarded in proportion to the bidder that offers the highest utilisation.</p> <p>Verification:</p> <p>The anticipated utilisation rate shall be supported by modelling and calculation according to the provided method for ICT Capacity and Utilisation [or for servers ISO/IEC 30134-5].</p>
CONTRACT PERFORMANCE CLAUSES	
	<p>CPC2.2 Monitoring of IT Equipment Utilization values</p> <p><i>To be included when the data centre is operated by a third party.</i></p> <p>The operator of the data centre facility shall provide average monthly data for the total IT [or servers] utilization rate of the data centre.</p>
Explanatory note: IT Capacity and Utilisation metric calculation method	
<p>If an overall IT equipment utilisation rate forms the basis for the criterion then the Green Grid IT Capacity and Utilisation metric calculation will need to be reproduced within an Annex of the criteria document.</p> <p>ICT Capacity – provisioned at theoretical maxima:</p> $ICT_C = \{CPU_C, MEM_C, STOR_C, NET_C\}$ <p>ICT Utilisation – percentages used of theoretical maxima:</p> $ICT_U = \{CPU_U, MEM_U, STOR_U, NET_U\}$	

Criterion 1.2: Equipment Utilization

Comments from stakeholders

- In general **strong support** for criteria to **maximise utilisation** for since it has a large impact on energy efficiency
- Utilisation depends on **workload type**. It makes not appropriate to introduce **utilisation targets**.
- It is better to have criteria to **encourage optimization** and **reporting** on utilisation. It should be rewarded the **optimisation strategy**
- **It is simpler to monitor and report CPU utilisation** rather than use the Green Grid metric $ICTU = \{CPUU, MEMU, STORU, NETU\}$.

Criterion 1.2: Equipment Utilization

Background research and follow-up

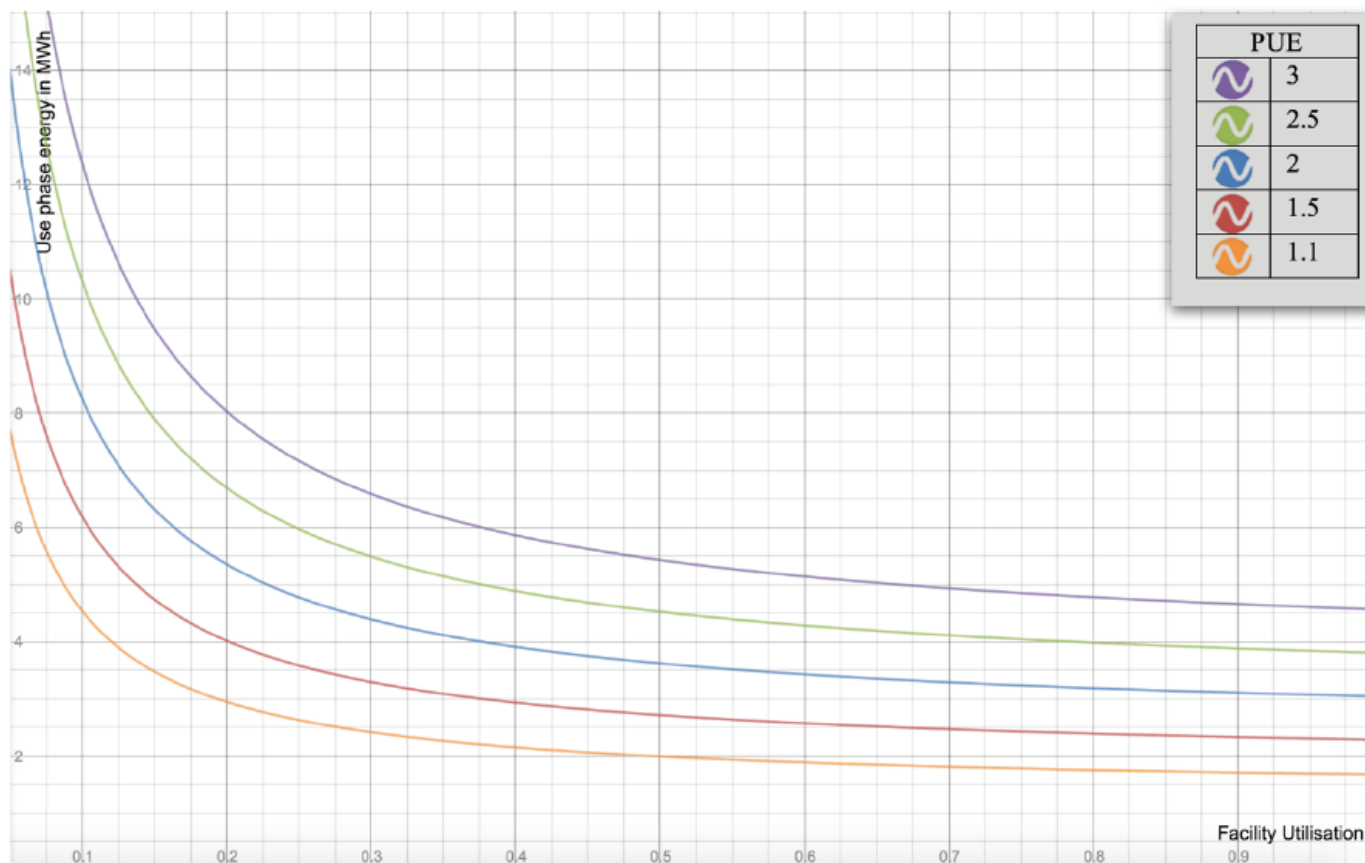


Fig. 4. Annual use phase energy consumption (in MWh) for running a workload $\omega = 1,986,066$ ssj_ops (workload equivalent to the average full capacity of 1 current server) vs facility utilisation level given PUE's of 1.1, 1.5, 2, 2.5 and 3.

Source: EURECA (2017)

Criterion 1.2: Equipment Utilization

Background research and follow-up

CPU utilisation is most frequently referenced as an indicator of utilisation and has been formalised in the standard ISO 30134-5 'IT Equipment Utilization for Servers'. This is a simple measurement of the CPU utilisation by use of a performance monitoring tool provided by a server operating system.

Annual average IT server utilisation is calculated as follows:

$$ITEU_{sv} = \frac{1}{a} \sum_{i=1}^a [ITEU_{sv}(t_0 + e \times i)]$$

Where:

a is the number of ITEU_{sv}(t) measurements intervals over a year (all intervals should be same length)

t_0 is the starting time of measurement

e is the interval of measurement where $e \times a = 1 \text{ year}$

Criterion 1.2: Equipment Utilization

Background research and follow-up

- EURECA (<https://www.dceureca.eu/>) provided relevant data about utilization in public sector data centres:
 - ✓ 4 EU countries
 - ✓ over 350 data centres
 - ✓ average annual server utilisation between 15% to 25%
 - ✓ some cases having as low as 10% utilisation, with a couple of cases at 35%.
- Needs for increasing the utilization rate, however a criterion for the "anticipated utilization rate" is unenforceable
- Automated workload management systems can help (such as Densify and TSOLogic, Baselayer, eVolution), however is difficult to set a TS based on the tool applied.

Criterion 1.2: Equipment Utilization

2nd Criteria Proposal

Core criteria	Comprehensive criteria
SELECTION CRITERIA	
<p><i>To be included when the data centre is operated by a third party.</i></p> <p>SC1.2.1 Server utilisation</p> <p>The tenderer must have relevant competencies and experience in optimization of a server's utilization. This must include server virtualization services, utilisation management tools and the consolidation of IT asset in data centres.</p> <p>Bidders must provide evidence of previous projects with similar workloads to achieve, maintain and improve utilisation of IT equipment. This includes descriptions of methods used to optimise utilisation.</p> <p>Verification:</p> <p>Evidence in the form of information and references related to relevant contracts in the last 3 years in which the above elements have been carried out. This must also be supported by CVs for personnel who will work on the project and their relevant project experience.</p>	<p><i>To be included when the data centre is operated by a third party.</i></p> <p>SC1.2.1 Server utilisation</p> <p>The tenderer must have relevant competencies and experience in optimization of a server's utilization. This must include server virtualization services, utilisation management tools and the consolidation of IT asset in data centres.</p> <p>Bidders must provide evidence of previous projects with similar workloads to achieve, maintain and improve utilisation of IT equipment. This includes descriptions of methods used to optimise utilisation.</p> <p>Verification:</p> <p>Evidence in the form of information and references related to relevant contracts in the last 3 years in which the above elements have been carried out. This must also be supported by CVs for personnel who will work on the project and their relevant project experience.</p>

Criterion 1.2: Equipment Utilization

2nd Criteria Proposal

AWARD CRITERIA		CONTRACT PERFORMANCE CLAUSES	
<p><i>To be included when the data centre is operated by a third party.</i></p> <p>AC1.2.1 Server utilisation</p> <p>Points must be award based on the anticipated server utilisation level based on the contracting authorities data handling and processing requirements. Points will be awarded in line with the following ranges:</p> <ul style="list-style-type: none"> >70% lower: [specified] points 40-70% lower: 0.8 x [specified] points 25-40% lower: 0.5 x [specified] points <p>Verification</p> <p>The rate will be supported by modelling, calculations or evidence provided in the selection criteria to achieve the anticipated utilisation.</p>	<p><i>To be included when the data centre is operated by a third party.</i></p> <p>AC1.2.1 Server utilisation</p> <p>Points must be award based on the anticipated server utilisation level based on the contracting authorities data handling and processing requirements.</p> <p>Points will be awarded in line with the following ranges:</p> <ul style="list-style-type: none"> >70% lower: [specified] points 40-70% lower: 0.8 x [specified] points 25-40% lower: 0.5 x [specified] points <p>Verification</p> <p>The rate will be supported by modelling, calculations or evidence provided in the selection criteria to achieve the anticipated utilisation.</p>	<p>CPC1.2.1 Monitoring of IT Equipment Utilization</p> <p><i>To be included when the data centre is operated by a third party.</i></p> <p>The service provider must provide periodical reporting of optimisation analysis and about the achievement of utilisation targets agreed with the client during the specific IT project</p> <p>The service provider must measure and monthly report the utilization rate of the servers in the data centre based on ISO 13034-5.</p>	<p>CPC1.2.1 Monitoring of IT Equipment Utilization</p> <p><i>To be included when the data centre is operated by a third party.</i></p> <p>The service provider must provide periodical reporting of optimisation analysis and about the achievement of utilisation targets agreed with the client during the specific IT project</p> <p>The service provider must measure and monthly report the utilization rate of the servers in the data centre based on ISO 13034-5.</p>
		<p>Explanatory note: IT Capacity and Utilisation metric calculation method</p> <p>Annual average IT server utilisation is calculated as follows:</p> $ITEU_{sv} = \frac{1}{a} \sum_{i=1}^a [ITEU_{sv}(t_0 + e \times i)]$ <p>Where:</p> <p>'a' is the number of ITEU_{sv}(t) measurements intervals over a year (all intervals should be same length)</p> <p>'t₀' is the starting time of measurement</p> <p>'e' is the interval of measurement, where e x a = one year</p> <p>The interval should be between 1 min and 1h (10 min default).</p>	

Criterion 1.1: Server efficiency

Discussion points

- **Selection criteria** would a focus on contractors competencies/experience bring improvements?
- **Award criteria** with three thresholds >25% utilisation – in which tenders could it be used?
- Use of **CPU utilisation** measurement as a proxy

Criterion 1.3.1: Optimization of Server Lifetime

1st criteria proposal

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATIONS	
<p>TS2.4 Design for durability</p> <p>The tenderer shall provide a minimum two-year warranty effective from delivery of the servers. This warranty shall cover repair or replacement and include a service agreement with options for pick-up and return or on-site repairs.</p> <p>The warranty shall guarantee that the products are in conformity with the contract specifications at no additional cost.</p> <p>Verification:</p> <p>The tenderer shall provide a written declaration that the products supplied will be warrantied in conformity with the contract specifications and service requirements.</p>	<p>TS2.4. Design for durability</p> <p>The tenderer shall provide a minimum three-year warranty effective from delivery of the servers. This warranty shall cover repair or replacement and include a service agreement with options for pick-up and return or on-site repairs.</p> <p>The warranty shall guarantee that the products are in conformity with the contract specifications at no additional cost.</p> <p>Verification:</p> <p>The tenderer shall provide a written declaration that the products supplied will be warrantied in conformity with the contract specifications and service requirements.</p>
AWARD CRITERIA ⁶¹	
	<p>AC2.4 Design for durability</p> <p>Points shall be awarded to each additional year of warranty and service agreement offered for servers that is more than the minimum technical specification (see criteria TS2.4).</p> <p>Points shall be awarded in proportion to the bidder that offers the longest warranty.</p> <p>Verification:</p> <p>A copy of the warranty and service agreement shall be provided by the tenderer. They shall provide a declaration that they cover the conformity of the goods with the contract specifications.</p>

Criterion 1.3.1: Optimization of Server Lifetime

Comments from stakeholders

- Defining a **default minimum time** period for refresh through a minimum **warranty** criterion was considered **inappropriate**
- The refresh period should be based on the balance of **energy savings** and additional **embodied energy** from the new server.
- Generally, stakeholders mentioned the **criteria could be misleading to public procurers** where the majority of **servers are already old (>5 years)** and inefficient.

Criterion 1.3.1: Optimization of Server Lifetime

Background research and follow-up

- Eureka results:
 - ✓ 40% of the servers in the public sector are more than 5 years old
 - ✓ Old servers have an high energy consumption and low compute capacity
 - ✓ majority of the environmental impacts from servers is associated with the use phase
 - ✓ Under the EURECA project it was developed a model to calculate the optimal refresh time

The calculation of the optimal server lifetime in technical specification TS2.3.1 must be done according to equation below:

$$\mu = \frac{E_e^r}{E_u^c} \left(1 - \frac{1}{2 \left(\frac{n}{1.5} \right)} \right)^{-1}$$

Where:

μ = optimal server lifetime when energy efficiency is achieved by the newly refreshed hardware (year x)

E_e^r = embodied energy of new server (MJ or kWh) – use 1000 kWh as default

E_u^c = total energy consumption of existing server at a fixed workload at time 'n' (MJ or kWh)

n = evaluation period which is normally > lifetime of existing server (x number of years)

Criterion 1.3.1: Optimization of Server Lifetime

Background research and follow-up

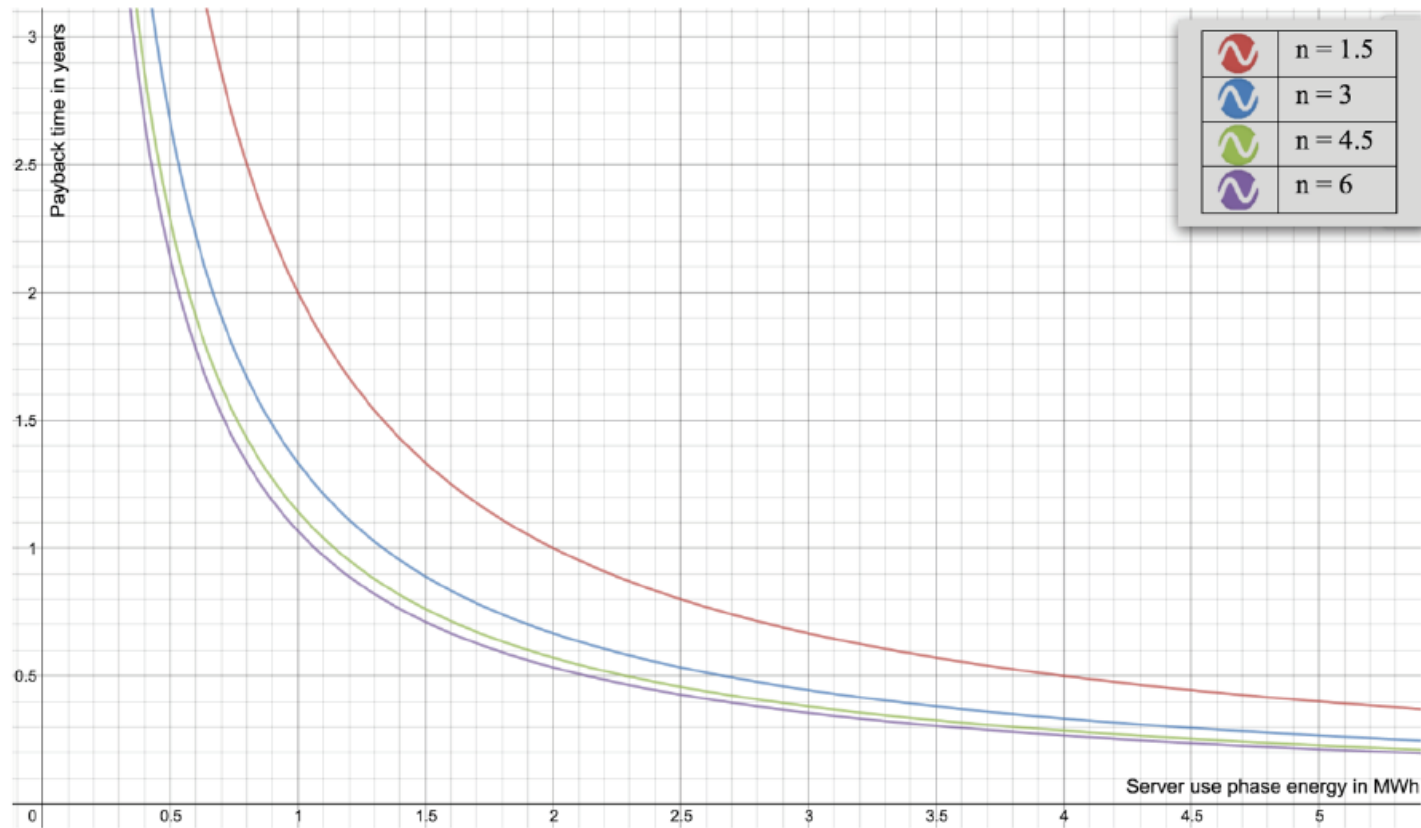


Fig. 2. Payback time after hardware refresh (1 server) introduced at point n in time (in intervals of 1.5 years) vs current annual server use phase energy in MWh, for $n = 1.5, 3, 4.5$ and 6 .

Source: EURECA (2017)

Criterion 1.3.1: Optimization of Server Lifetime

2nd Proposal

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATIONS	
	<p>TS1.3.1 Optimisation of server lifetime</p> <p><i>This criterion is only applicable to managed service providers</i></p> <p>Bidders must refresh the servers they will manage according to calculation of the optimal server lifetime [<i>formula in the explanatory note to be included in the tender documentation</i>]. Both new and existing servers must deliver comparable workloads.</p> <p>Verification:</p> <p>Ongoing monitoring of the refreshment planning is detailed in CPC1.3.1</p>

CONTRACT PERFORMANCE CLAUSES	
	<p>CPC1.3.1 Optimisation of server lifetime</p> <p>Calculation of the optimal server lifetime (i.e. server refresh) will be done using the EURECA metric.</p> <p>The tenderer must compile and manage data on calculated optimal server lifetime according to EURECA metric as well as data on the parameters that form part of this metric.</p>

Criterion 1.3.1: Optimization of Server Lifetime

Discussion points

- Use of **EURECA metric** for refresh rate
- Targeted for use by **managed service providers**
- Input assumptions for embodied energy and improvement scenario
 - e.g. Default **embodied energy** figure for a server (1000 kWh) is quite old (2004)

Criterion 1.3.2: Design for disassembly and repair of servers

1st criteria proposal

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATIONS	
<p>TS2.5 Design for disassembly and repair</p> <p>The tenderer shall provide clear disassembly and repair instructions (e.g. hard or electronic copy, video) to enable a non-destructive disassembly of servers for the purpose of replacing key components or parts for upgrades or repairs. This shall be made available in hard copy or via the manufacturer's webpage.</p> <p>Verification:</p> <p>A manual shall be provided by the tenderer, which shall include an exploded diagram of the device illustrating the parts that can be accessed and replaced, and the tools required. It shall also be confirmed which parts are covered by service agreements under the warranty.</p>	<p>TS2.5 Design for disassembly and repair</p> <p>The tenderer shall provide clear disassembly and repair instructions (e.g. hard or electronic copy, video) to enable a non-destructive disassembly of servers for the purpose of replacing key components or parts for upgrades or repairs. This shall be made available in hard copy or the manufacturer's webpage.</p> <p>Verification:</p> <p>A manual shall be provided by the tenderer which shall include an exploded diagram of the device illustrating the parts that can be accessed and replaced, and the tools required. It shall also be confirmed which parts are covered by service agreements under the warranty.</p>
AWARD CRITERIA ⁶¹	
Core criteria	Comprehensive criteria
<p>AC2.5 Design for disassembly and repair</p> <p>The tenderer shall guarantee the availability of spare parts for servers for at least three years from the date of purchase.</p> <p>Verification:</p> <p>The tenderer shall provide a declaration that compatible spare parts will be made available to the contracting authority or through a service provider.</p>	<p>AC2.5 Design for disassembly and repair</p> <p>The tenderer shall guarantee the availability of spare parts for servers for at least five years from the date of purchase. Compatible parts with improved capacity or performance, where relevant, shall be made available.</p> <p>Verification:</p> <p>The tenderer shall provide a declaration that compatible spare parts will be made available to the contracting authority or through a service provider.</p>

Criterion 1.3.2: Design for disassembly and repair of servers

1st criteria proposal

Core criteria	Comprehensive criteria
	<p>TS2.6 Design for dismantling and recycling</p> <p>For each server model to be used in execution of the contract the bidder shall provide a 'dismantling test report' detailing the specific steps and tools required to recover:</p> <ul style="list-style-type: none">• Printed Circuit Boards relating to computing functions with a size of >10cm²• Internal Power Supply Units• HDD/SSD drives <p>Verification:</p> <p>The tenderer shall upon award provide a 'dismantling test report' for the relevant models of IT equipment. The test shall be carried out by a specialised WEEE recycling firm that is a permitted electrical waste treatment operation in accordance with Article 23 of the Waste Framework Directive or that are certified under equivalent national or international WEEE regulations or standards. Third party verification of the timing shall be accepted as an alternative to providing a recording.</p>

Criterion 1.3.2: Design for disassembly and repair of servers

Background research and follow-up

- Common practice in [spare parts availability](#) already meet or exceed this requirement (e.g. three years of spare parts availability). No added value.
- The criteria must go [further](#) the alignment with [WEEE](#) which is already a legal obligation (e.g. information for treatment facilities).
- Manufacturers need to be encouraged to take back and deal with equipment which they did [not produce](#) but that their equipment is replacing.
- Providing disassembly [instructions](#) may be helpful especially for companies that are not connected to the [original equipment manufacturers](#) and in combination with take back schemes

Criterion 1.3.2: Design for disassembly and repair of servers

Background research and follow-up

Draft Ecodesign Regulation on Servers: requirements on disassembly and repair:

- ✓ **Joining, fastening or sealing** techniques do not prevent the disassembly of the following components:
- ✓ Data storage devices
- ✓ Memory
- ✓ Processor (CPU)
- ✓ Motherboard
- ✓ Expansion card/graphic card
- ✓ Power supply

NSF/ANSI 426 – 2017 → EPEAT Criteria for Servers (Aug 2018)

Additional requirements on disassembly for key components:

- ✓ Shall be **removable/replaceable by hand** with **commonly available tools**
- ✓ wires and cables -> removable
- ✓ Fans -> replaceable

Criterion 1.3.2: Design for disassembly and repair of servers

2nd criteria proposal

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATIONS	
	<p>TS1.3.2 Design for disassembly and repair of servers</p> <p><i>This criterion is only applicable to the procurement of new servers in an enterprise data centre</i></p> <p>The tenderer must provide clear disassembly and repair instructions (e.g. hard or electronic copy, video) to enable a non-destructive disassembly of servers for the purpose of replacing the following components for upgrades or repairs:</p> <ul style="list-style-type: none"> – external enclosures, or those portions of the enclosures that must be removed to accomplish repair – HDD and SSD data drives, indicating the presence of rare earth elements in magnets, – memory, – processor (CPU), – motherboard, – expansion cards/graphic cards, – power supply and/or – fans – casing – wires and cables that connect to external sources of power <p>The instructions must be made available in hard copy to end-users, and to reuse and recycling organisations upon request and via the manufacturer's webpage. The manufacturer must have a written procedure that requires the instructions to be made available for a minimum of 7 years following the end of production of the product.</p> <p>Verification:</p> <p>The instructions which must include an exploded diagram of the server(s) illustrating how the relevant parts can be accessed and replaced, and the tools required. The instructions must also inform which parts are covered by service agreements under the warranty.</p>

Criterion 1.3.2: Design for disassembly/repair of servers

Discussion points

- One criteria covering [repair and disassembly](#)
- [Only comprehensive criteria](#) extending Ecodesign component scope to reflect the NSF listing
- Focus on [providing information \(instructions\)](#) rather than demonstrating feasibility
- Dismantling criteria deleted because of [high level of overlap](#) and [repairability was considered a priority](#)

Criterion 1.3.3/4: Hazardous substances

1st criteria proposal

AWARD CRITERIA	
	<p>AC2.3 Emissions of hazardous substances – printed circuit boards</p> <p>Points shall be awarded where the main Printed Circuit Board of the server models used are 'halogen free' in conformance with IEC 61249-2-21 and a fire test simulating improper WEEE disposal shows carcinogenic Polycyclic Aromatic Hydrocarbon (PAHs) emissions to be ≤ 0.1 mg TEQ /g.</p> <p>Verification:</p> <p>Test reports for the board composition and emissions shall be provided upon award for the ready-to-install motherboard as relevant for the server models used.</p> <p>The fire test shall be carried out according to ISO 5660 in oxidative pyrolysis conditions (IEC 60695-7-1 fire type 1b with a heat flux of 50 kW/m²). Quantification of the PAHs emissions shall be made according to ISO 11338 (PAHs).</p>

Criterion 1.3: Hazardous substances

Stakeholder comments

- Current regulation such as [RoHS](#) and the [REACH SVHC List](#) limit the use of hazardous materials.
- A hazardous substances criterion based on [existing compliance](#) would add no real value, as most equipment does not enter the usual electrical waste stream.
- Proposal for inclusion of a restricted substances criterion in line with [NSF/ANSI 426-2017](#) and the [Computers and Monitors EU GPP](#) document.
- Work for the US [NSF standard](#) (by INEMI) shows it is not possible to use the same flame retardant substitutions for enterprise servers as for consumer goods, but innovation could be encouraged by an award criteria.
- [Halogen free circuit boards](#) would avoid hazardous emissions and can be verified using IEC 61249-2-21
- [Hazardous phthalates](#) are set to be restricted from 2019 under an amendment to the RoHS Directive, and should therefore be omitted.

Criterion 1.1: Hazardous substances

Background research and follow-up

- Manufacturers used a combination of IEC 62476 and IEC 62474 to operate overall restricted substance controls.
- OEMs that take back servers have the systems in place to ensure that components of concern are recycled
- Contact with Umicore and other stakeholders indicates that the right processes are available to effectively disassemble, recycle and reuse servers, but the biggest end-of-life problem is ensuring this happens.
- Re-usable parts are generally harvested and tested before reaching recycling facilities (e.g. cables)
- No specific evidence could be found demonstrating a specific risk related to server PCB and cables

Criterion 1.3: End of life management

1st criteria proposal

TECHNICAL SPECIFICATIONS	
Core criteria	Comprehensive criteria
<p>TS2.7 End of life management</p> <p>Tenderers shall provide a re-use and recycling service once the servers have reached the end of its service life. They shall report on the proportion of equipment re-used or recycled, supported by details of the following:</p> <ul style="list-style-type: none"> - Collection; - Confidential handling and secure data erasure (Unless carried out in-house); - Testing, servicing and upgrading ⁵⁹; - Remarketing for re-use in the EU; - Dismantling for recycling and/or disposal. <p>Preparation of items for re-use, as well as recycling and disposal operations shall be carried out in full compliance with the requirements in Article 8 and Annexes VII and VIII of the (recast) WEEE Directive 2012/19/EU 60.</p> <p>Verification:</p> <p>The tenderer shall provide details of the arrangements for collection, data security, testing, remarketing for re-use and recycling/disposal. This shall include, during the contract, valid certifications of compliance for the WEEE handling facilities to be used.</p>	<p>TS2.7 End of life management</p> <p>Tenderers shall provide a re-use and recycling service once the servers have reached the end of its service life. They shall report on the proportion of equipment re-used or recycled, supported by details of the following:</p> <ul style="list-style-type: none"> - Collection; - Confidential handling and secure data erasure (Unless carried out in-house); - Testing, servicing and upgrading; - Remarketing for re-use in the EU; - Dismantling for recycling and/or disposal. <p>Preparation of items for re-use, as well as recycling and disposal operations shall be carried out in full compliance with the requirements in Article 8 and Annexes VII and VIII of the (recast) WEEE Directive 2012/19/EU.</p> <p>Verification:</p> <p>The tenderer shall provide details of the arrangements for collection, data security, testing, remarketing for re-use and recycling/disposal. This shall include, during the contract, valid certifications of compliance for the WEEE handling facilities to be used.</p>

Criterion 1.3: End of life management

1st criteria proposal

AWARD CRITERIA

AC2.7 End of life management

Points shall be awarded to tenderers operating a tracking system for servers with a unique identifier for each item of IT equipment in their inventory. The system shall enable the proportion of items re-used or recycled to be verified, and whether they remained in the EU or were exported.

Verification:

The tenderer shall provide details of the tracking system that they operate.

CONTRACT PERFORMANCE CLAUSES

CPC2.7 Reporting on equipment status

The successful tenderer shall provide a report on the status of the server equipment in the inventory once all items have been processed for re-use or recycling/disposal. The report shall be made according to ETSI EN 305 174-8 and shall identify the proportion of items re-used or recycled, whether they remained in the EU or were exported.

Criterion 1.3: End of life management

Stakeholder comments

- Current regulations (WEEE) do not stop operators from **shipping outside the EU**.
- There is nothing preventing **leaks of equipment** before it reaches the recycling facility.
- Points should therefore be awarded for contracts where all **WEEE is shipped to WEEE and e-scrap certified (pre) processing companies** (via AATF – approved authorized treatment facilities and AE – approved exporters) in order to deter companies from shipping elsewhere.
- **Data protection** was considered a huge barrier in the area and would be controlled by using a competent WEEE waste handler (as described above).
- The criteria provided little value over existing legislation (lots at EU and national level – WEEE and RoHS), yet added to reporting requirements.
- **Pre-treatment and selective disassembly** should be encouraged

Criterion 1.3: End of life management

Background research and follow-up

- **Manufacturers and retailers** in the data centre business already provide a way to dispose of the equipment via existing collection and take back schemes.
- **Take back schemes** are already well in place for stock existing since the implementation of the legal framework (2012)
- **Older WEEE equipment** (manufactured before 2012) which is to be disposed, is still covered by the producer responsibility principle
- Ongoing efforts are focusing on increasing the **availability of WEEE compliant handling facilities** across the EU, which will prevent illegal shipments
- **International compliance schemes** are also used and are encouraged in the criteria of labels such as EPEAT

Criterion 1.3: Hazardous substances and end of life management

Discussion points

- Selection of equipment suppliers based on their restricted substance controls with reference to IEC standards
- Simplified focus on ensuring that Printed Circuit Boards and external cables are separated and recycled
- Technical specification for services goes further than WEEE compliance - prioritises reuse and recycling
- WEEE selective treatment and disassembly compliance for EU and non-EU operators

Criterion 1.4. : Temperature Operating Range

1st Criteria Proposal

TECHNICAL SPECIFICATIONS	
Core criteria	Comprehensive criteria
<p>TS2.8 Cooling Management –higher temperature hardware</p> <p>Select ICT hardware which is warrantied to operate within allowable temperature range of 15-32C.</p> <p>Verification:</p> <p>Manufacturers specifications and warranties shall be provided for each major IT hardware component..</p>	<p>TS2.8 Cooling Management –higher temperature hardware</p> <p>Select ICT hardware which is warrantied to operate within an allowable temperature range of 10-35C.</p> <p>Verification:</p> <p>Manufacturers specifications and warranties shall be provided for each major IT hardware component..</p>

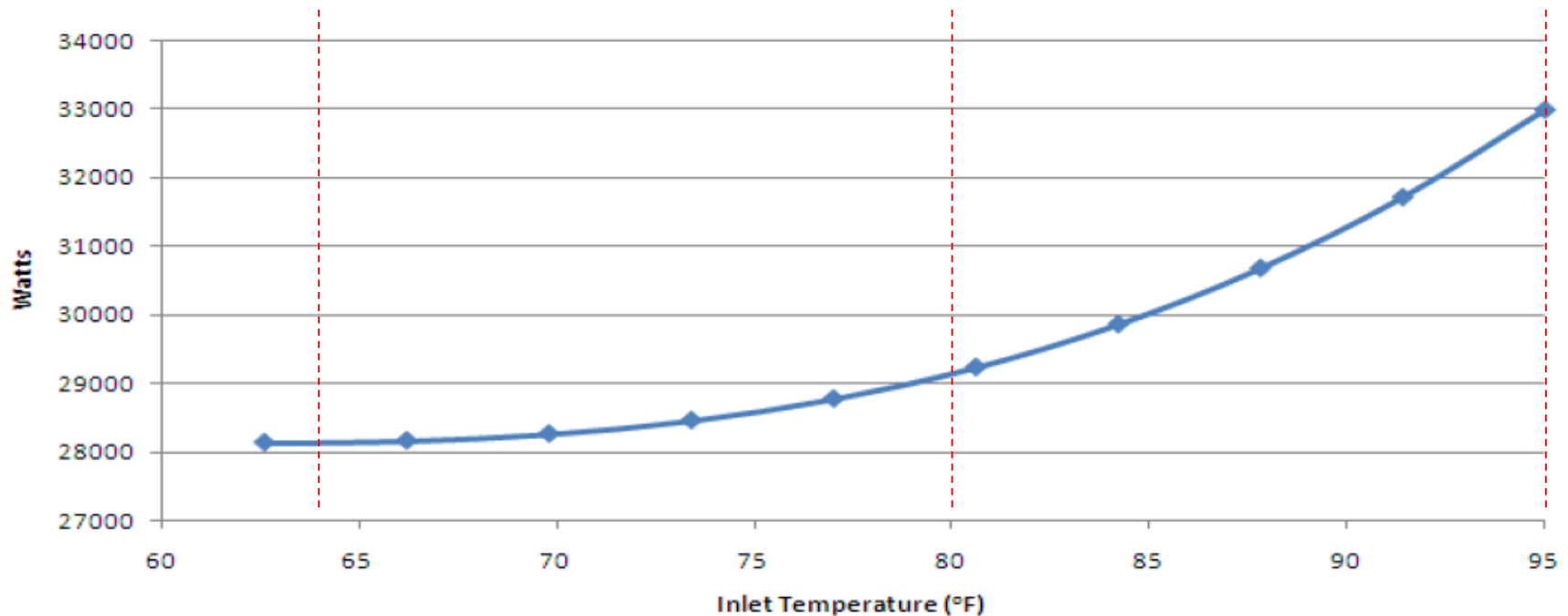
Criterion 1.4. : Temperature Operating Range

Comments from stakeholders

- ICT with a wider temperature range would **not** deliver **directly an energy efficiency benefit**. It will depend on:
 - ✓ Environmental conditions and airflow management
 - ✓ Allowable is not recommended temperatures
 - ✓ Server fans rump up
- **Warranties** for existing equipment are normally issued by manufacturer according to **less ambitious ASHRAE levels (A1/A2)**
- Equivalent criteria **for liquid cooled** facilities were suggested

Criterion 1.4. : Temperature Operating Range

Background research and follow-up



Source: Schneider Electric (2011)

Criterion 1.4. : Temperature Operating Range

Background research and follow-up

- Draft Ecodesign Implementing Measure for servers:
 - ✓ Information requirement on operating condition class
 - ✓ A3/A4 class servers are the best available technologies
- EU Code of Conduct for Energy Efficiency in Data Centres (2018):
 - ✓ Include the operating temperature and humidity ranges at the air intake of new equipment as high priority decision factors in the tender process.
 - ✓ Equipment should be able to withstand and be within warranty for the full range A2 (10-35°C) or at A1 (15-32°C)

Criterion 1.4. : Temperature Operating Range

2nd Criteria Proposal

TECHNICAL SPECIFICATIONS	
Core criteria	Comprehensive criteria
<p>TS1.4.1 ICT Operating Range –higher temperature hardware</p> <p><i>Applicable in the case of air cooling</i></p> <p>ICT hardware must be warrantied to operate within an allowable temperature range of 15-32C.</p> <p><i>Applicable in the case of liquid cooling</i></p> <p>ICT hardware must be warrantied to operate within a facility supply temperature range of 2-17C.</p> <p>Verification:</p> <p>Manufacturers specifications and warranties must be provided for each piece of ICT equipment.</p>	<p>TS1.4.1 ICT Operating Range – higher temperature hardware</p> <p><i>Applicable in the case of air cooling</i></p> <p>ICT hardware must be warrantied to operate within an allowable temperature range of 10-35C.</p> <p><i>Applicable in the case of liquid cooling</i></p> <p>ICT hardware must be warrantied to operate within a facility supply temperature range of 2-27C.</p> <p>Verification:</p> <p>Manufacturers specifications and warranties must be provided for each piece of ICT equipment.</p>

Criterion 1.3: Hazardous substances and end of life management

Discussion points

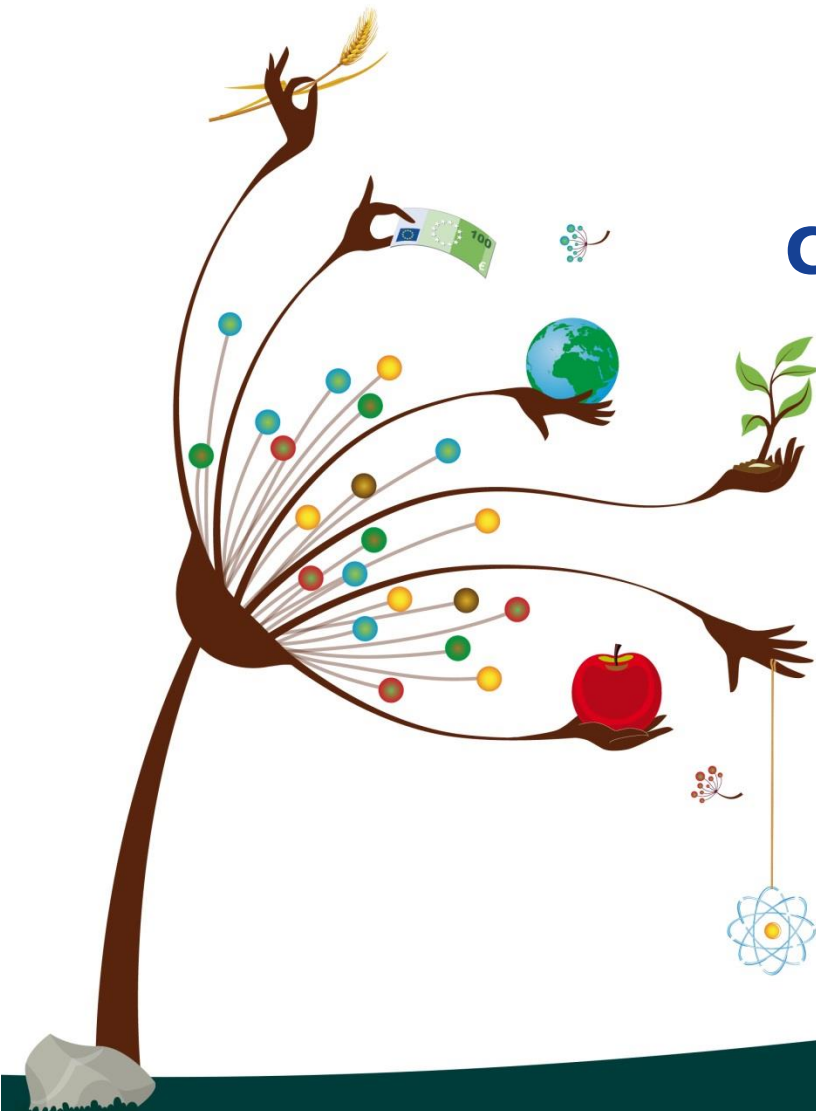
- Operating range v. warranty conditions
- Value of a criteria that supports greater flexibility e.g. the use of free cooling
- Issue of ramp up fan energy use could be flagged up in the guidance?

The European Commission's science and knowledge service

Joint Research Centre

Criteria Area 2: Mechanical & Electrical systems

29th May 2018



Criterion 2.1: Power Utilisation Effectiveness (PUE)

1st criteria proposal

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATIONS	
<p>TS3.1 Target Power Usage Effectiveness (PUE)</p> <p>The bidder shall demonstrate that the predicted design PUE of the data centre facility is lower than 1.4 at 100% IT equipment load (based on typical annual weather data).</p> <p>Verification:</p> <p>Design calculations which show how the target is met according to ISO/IEC 30134:2016 Part 2, EN 50600-4-2:2016 or equivalent.</p>	<p>TS3.1 Target Power Usage Effectiveness (PUE)</p> <p>The bidder shall demonstrate that the predicted design PUE of the data centre facility is lower than 1.3. at 100% IT equipment load (based on typical annual weather data).</p> <p>Verification:</p> <p>Design calculations which show how the target is met according to ISO/IEC 30134:2016 Part 2, EN 50600-4-2:2016 or equivalent.</p>

Criterion 2.1: Power Utilisation Effectiveness (PUE)

1st criteria proposal

AWARD CRITERIA	
<p>AC3.1 Power Usage Effectiveness (PUE)</p> <p>For newly designed facilities (not yet operational) or existing facilities less than 1 year old (from start of operation), points could be awarded in one of two ways:</p> <ol style="list-style-type: none"> 1. Relative to the benchmark PUE value above (TS1.1 core) 2. Relative to the best performing PUE offer (full points) <p>For newly designed facilities (not yet operational), points could be awarded relative to the best predicted design PUE at 25% IT load.</p> <p>For existing facilities operational for between 1-5 years, points could be awarded where the bidder can demonstrate that the measured PUE of the data centre facility would be less than 1.6 at 100% load.</p> <p>For existing facilities operational for more than 5 years, points could be awarded where the bidder can demonstrate that the measured PUE of the data centre facility would be less than 1.8 at 100% load.</p> <p>Verification:</p> <p>Design calculations which show how the target is met or measurements as applicable according to ISO/IEC 30134:2016 Part 2, EN 50600-4-2:2016 or equivalent.</p>	<p>AC3.1 Power Usage Effectiveness (PUE)</p> <p>For newly designed facilities (not yet operational) or existing facilities less than 1 year old (from start of operation), points could be awarded in one of two ways:</p> <ol style="list-style-type: none"> 1. Relative to the benchmark PUE value above (TS1.1 comprehensive) 2. Relative to the best performing PUE offer (full points) <p>For newly designed facilities (not yet operational), points could be awarded relative to the best predicted design PUE at 25% IT load.</p> <p>For existing facilities operational for between 1-5 years, points could be awarded where the bidder can demonstrate that the measured PUE of the data centre facility would be less than 1.45 at 100% load.</p> <p>For existing facilities operational for more than 5 years, points could be awarded where the bidder can demonstrate that the measured PUE of the data centre facility would be less than 1.65 at 100% load.</p> <p>Verification:</p> <p>Design calculations which show how the target is met or measurements as applicable according to ISO/IEC 30134:2016 Part 2, EN 50600-4-2:2016 or equivalent.</p>

Criterion 2.1: Power Utilisation Effectiveness (PUE)

Stakeholder comments

- PUE is a **widely used metric** which has been useful in driving energy efficiency.
- It is **not an efficiency metric** and can be lowered (improved) by increasing the IT load
- **Smaller data centres** would struggle to improve PUE (consolidation, applications, refresh rates and utilization become important), and a Dutch example was given where it became a barrier to equipment replacement.
- Some stakeholders suggested focusing on **cooling loads** – for example CoP or adapting the M&E equipment to the IT cooling needs (predicted performance therefore becomes the focus)
- Many of the difficulties with PUE are also true of **alternative metrics** (including **DCIE** which was also suggested)
- Other options proposed: **cooling system management**, **EU CoC best practices**, use stage energy consumption divided by output ('useful work')

Criterion 2.1: Power Utilisation Effectiveness (PUE)

Background research and follow-up

A number of 'best practice' measures were suggested as being considered as **design** and **monitoring** tools

- Reward the use of **CFD (computational fluid dynamics)** thermal simulation to optimise cooling systems.
 - Useful particularly at the **design stage**, however, it is a complex tool and simple design decisions may still deliver results.
 - It is **not considered essential** to achieve a low PUE and/or does not always guarantee a low PUE
- **Real-time, analytics-based cooling system management** is available from a limited number of vendors
 - **May not always achieve the desired results** or improve on those achieved by simpler and cheaper alternatives.
 - Use of **centralised control** may create the risk of a central controller disabling the cooling = '*global monitoring, local control*'.

Criterion 2.1: Power Utilisation Effectiveness (PUE)

Discussion points

- Restriction of the use of PUE to situations where **IT power use is already known** e.g. *consolidation to a co-location site*
- Value of including **commissioning/handover stage test** based on a simulated ('dummy') IT load
- *Shift of focus to **cooling systems** and **operating systems control***

Criterion 2.2: Reuse of waste heat

1st criteria proposal

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATIONS	
	<p>TS3.2 Waste heat reuse</p> <p><i>The criterion should be adapted to the local availability of district heating systems and networks. It is recommended to set a comprehensive technical specification in the case that there is ready access.</i></p> <p>The data centre shall be connected to and supply at least 30% of the data centre's waste heat expressed as the Energy Reuse Factor to the local district heating network.</p> <p>Verification:</p> <p>The Energy Reuse Factor (ERF) shall be calculated for each facility according to ETSI ES 205 200-2-1.</p> <p>The tenderer shall provide design engineering drawings for the heat reuse systems and connection. Evidence of contractual arrangements or letters of intent shall be obtained from the network operator.</p> <p>Upon request the contracting authority shall be provided with access to the equipment and network connection on-site at the data centre for auditing purposes.</p>

Criterion 2.2: Reuse of waste heat

1st criteria proposal

AWARD CRITERIA	
	<p>AC3.2a Waste heat reuse (for new data centres)</p> <p><i>The criterion should be adapted to the local availability of district heating systems and networks. It is recommended to set a comprehensive award criterion in the case that there are local opportunities identified by a public authority.</i></p> <p>Points shall be awarded to bidders that commit to supplying more than 30% of the data centre's waste heat expressed as the Energy Reuse Factor to local end-users. An additional point shall be given for every 10% of extra waste heat the data centre supplies.</p> <p>Verification:</p> <p>The Energy Reuse Factor (ERF) shall be calculated for each facility according to ETSI ES 205 200-2-1.</p> <p>The tenderer shall provide design engineering drawings for the heat reuse systems and connection. Evidence of contractual arrangements or letters of intent shall be obtained from potential heat customers.</p>
CONTRACT PERFORMANCE CLAUSES	
	<p>CPC3.2 Monitoring of the heating supply and connection</p> <p><i>To be included when the data centre is operated by a third party.</i></p> <p>The operator of the data centre facility shall provide average monthly data for the heat supplied to the local district heating network.</p> <p>In addition the Energy Reuse Factor (ERF) shall be calculated according to ETSI ES 205 200-2-1 and reported on.</p>



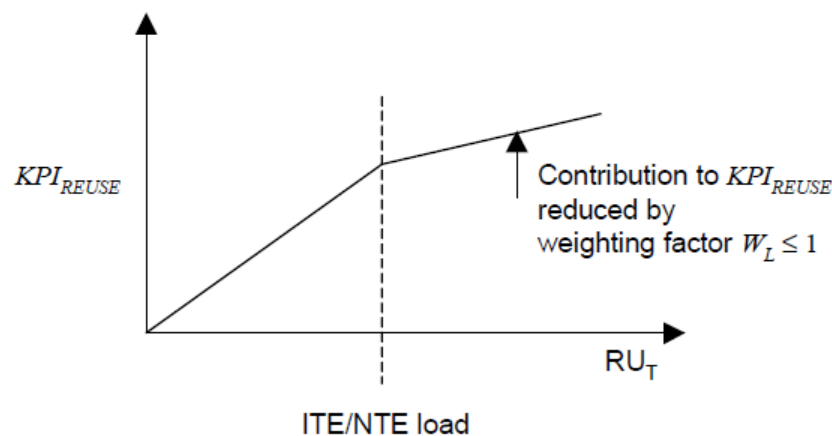
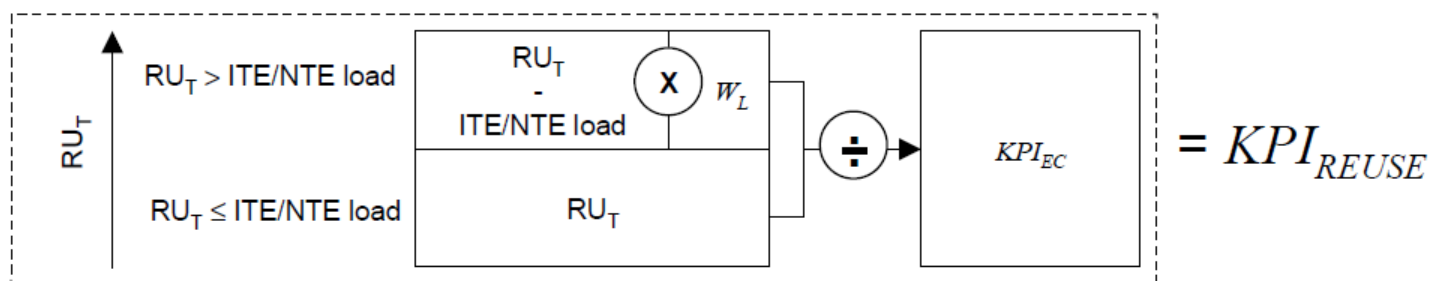
Criterion 2.2: Reuse of waste heat

Stakeholder comments

- Stakeholders recognised the value of this proposal, but felt there were **limited sites where it is possible**.
- **a rebound effect** could lead to an incentive to create heat more in the first place
- Reuse should be considered within the **overall energy efficiency**
- The criteria should show a **clear relationship to existing infrastructure** and **suitable end users**
- Omitting criteria that could enable locations **with no access to a district heating network from achieving points** from their reuse of waste heat seemed unfair
- This type of on-site reuse is **easy and should be implemented everywhere**

Criterion 2.2: Reuse of waste heat

Background research & follow-up



Source: ETSI (2014)

Criterion 2.2: Reuse of waste heat

Background research & follow-up



Criterion 2.2: Reuse of waste heat

Discussion points

- Use in the case of the **local availability** of district heating systems
- Comprehensive technical specification in the case that there is **ready access**
- Does the 30% threshold still work for **heat reuse on site**

Criterion 2.3.1 : Operating conditions control

1st Criteria Proposal

Core criteria	Comprehensive criteria
AWARD CRITERIA ⁸¹	
	<p>AC3.3 Cooling Management – operating at higher temperatures</p> <p>The data centre designer (or operator) shall be awarded points based on the % of operating hours that that the environmental conditions will be maintained within the temperature range of 18-27°C.</p> <p>In the case of data centre operators, this proposed performance shall form part of a service level agreement (SLA)</p> <p>Verification:</p> <p>The tenderer shall state the operating conditions that they will provide supported by the calculations on which they are based..</p>

Criterion 2.3.1 : Operating conditions control

Comments from the stakeholders

- Stakeholders felt that the draft criteria were **too prescriptive**;
- Concerns about the **ramping up of server fans**.
- **Holistic approach is needed** (monitoring, air flow management , cooling plant design, CRAC / CRAH design) -> all these aspects affect the energy consumption for cooling
- Integration of **relevant standards**: EN 50600-2-3, EN 50600 TR99 -1 / EU Code of Conduct)

Criterion 2.3.1 : Operating conditions control

2nd Proposal

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATIONS	
<p>TS2.3.1 Environmental monitoring</p> <p>The bidder must demonstrate that the facility has environmental control facilities and infrastructures in line with the requirements and recommendation of the standard EN 50600-2-3 capable of measuring:</p> <ol style="list-style-type: none"> 1) Computer room temperatures: <ol style="list-style-type: none"> a) supply air temperature; b) return air temperature; c) cold aisle temperature (where used); d) hot aisle temperature (where used). 2) Relative humidity: <ol style="list-style-type: none"> a) External relative humidity b) Computer room relative humidity 3) Air pressure under the access floor (in case of access floor is installed) 4) Coolant flow rates (in case the design of the environmental control system relies on the movement of fluids, e.g. water cooling) <p>Verification:</p> <p>The bidder must provide designs and technical specification monitoring system to be installed..</p>	

Criteria 2.3.2 -2.3.3 and 2.3.4: Cooling System Best Practices

New proposal

Comprehensive Criteria

TS2.3.2 Cooling systems best practices – new build or retrofit of data centres – Air Flow design and management

The bidder must demonstrate that the design incorporates the expected best practices listed in the most recent version of [EU CoC reference / EN50600 TR99-1:2017 reference]. The list as of 2017 comprises the following

- 5.1.1 / 5.17.57 Design – Hot /Cold aisle
- 5.1.2 / 5.17.58 Design – Contained hot or cold aisle
- 5.1.5 / 5.17.59 Cabinet air flow management – Other openings
- 5.1.6 / 5.17.60 Provide adequate free area on cabinet doors
- 5.1.11 / 5.17.49 Equipment segregation
- 5.1.12 / 5.17.14 Separate environmental zones

Verification:

The bidder must provide designs and drawings for the airflow design.

TS2.3.3 Cooling systems best practices – new build or retrofit of data centres – Cooling Plant Design

The bidder must demonstrate that new Cooling Plant designs and/or installations must incorporate the expected best practices listed in the most recent version of [EU CoC reference / EN50600 TR99-1:2017 reference]. The list as of 2017 comprises the following:

- 5.4.2.1 / 5.16.57 Chillers with high COP
- 5.4.2.3 / 5.16.58 Efficient part load operation
- 5.4.2.4 / 5.16.59 Variable speed drives for compressors, pumps and fans
- 5.4.2.5 / 5.16.60 Select systems which facilitate the use of "Free Cooling"
- 5.4.2.6 / 5.16.61 Do not share data centre chilled water system with comfort cooling
- 5.4.2.7 / 5.16.62 Do not allow non IT equipment to dictate cooling system set
- 5.4.2.8 / 5.16.63 Chilled water pump control strategy

Verification:

The bidder must provide designs and technical specification for the cooling plant to be installed.

TS2.3.4 Cooling systems best practices – new build or retrofit of data centres – Air Conditioning / Air Handling

- The bidder must demonstrate that new air conditioning / air handling systems within the computer rooms must incorporate the expected best practices listed in the most recent version of [EU CoC reference / EN50600 TR99-1:2017 reference]. The list as of 2017 comprises the following: 5.5.1 / 5.16.64 Variable Speed Fans
- 5.5.2 / 5.16.65 Control on CRAC / CRAH unit supply air temperature
- 5.5.5 / 5.16.66 Do not control humidity at CRAC / CRAH unit
- 5.5.6 / 5.16.67 Cooling unit sizing and selection

Verification:

The bidder must provide designs and technical specification for the air conditioning / air handling system to be installed.

Criterion 2.3.1 : Operating conditions control

2nd Proposal

AWARD CRITERIA	
	<p>AC2.3.1 Cooling system energy consumption</p> <p>The bidders must be awarded points based on the estimated cooling energy consumption required to operate the data centre design under reference climatic conditions for the location. Points will be awarded relative to the best performing design offer (full number of specified points).</p> <p>Verification:</p> <p>The tenderer must provide documentation, modelling and calculations for the design estimation process.</p>
CONTRACT PERFORMANCE CLAUSES	
	<p>CPC2.3.1 Monitoring of cooling system energy consumption</p> <p><i>To be included when the data centre is operated by a third party. To be used in conjunction with AC 2.3.1.</i></p> <p>The operator of the data centre facility must provide monthly and annual data for the cooling system energy consumption for the data centre. The monitoring must be specified according to the guidelines in EN 50600-4-2:2016 or equivalent.</p>

Criteria 2.3.2 -2.3.3 and 2.3.4: Cooling System Best Practices

Discussion points

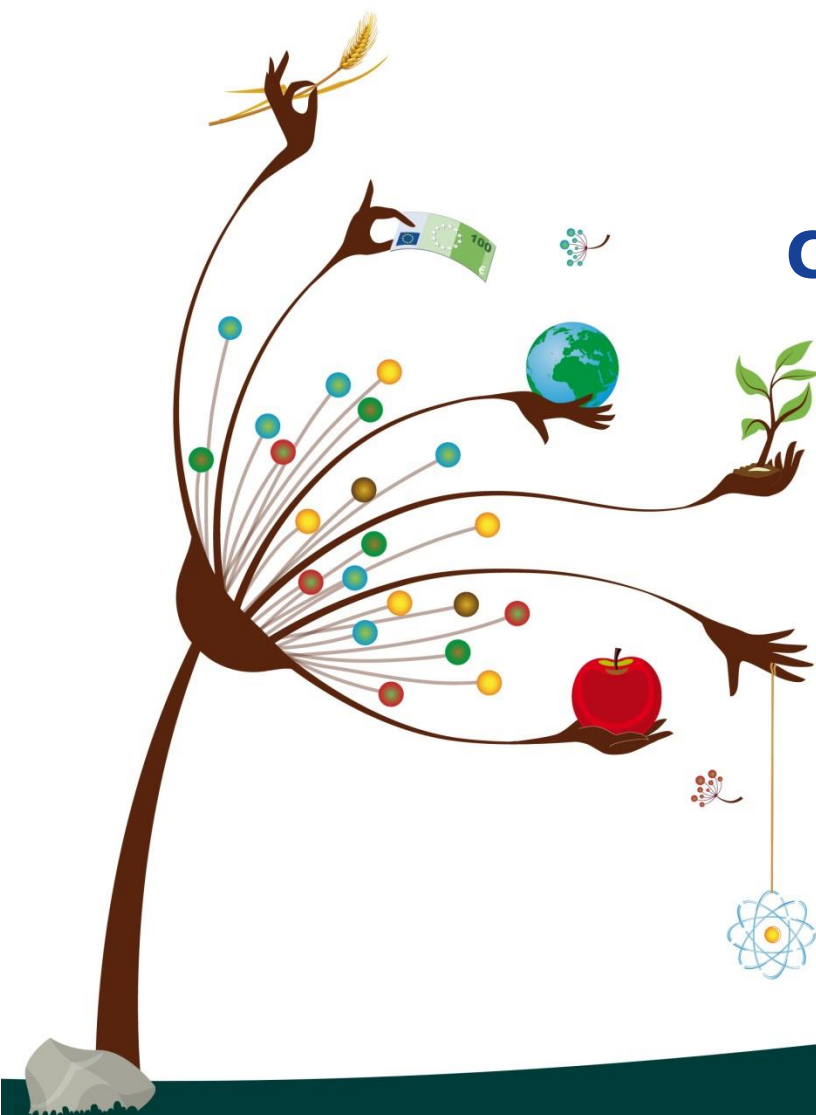
- Minimum focus on the importance of **control/monitoring**
- Technical specification based on the CoC – reference to '*expected minimum level of energy saving activity for Participant status*'
- Is this CoC based approach **too restrictive**?
- **Verification** upon installation?

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Criteria Area 3: System Level Performance

30th May 2018



Criterion 3.1: Renewable energy factor

1st criteria proposal

Core criteria	Comprehensive criteria
AWARD CRITERIA	
	<p>AC1.1 Renewable Energy Factor</p> <p><i>To be included when the data centre is operated by a third party.</i></p> <p>The contractor shall maximise the amount of renewable electricity used to provide the service. Points shall be awarded in proportion to the bidder that offers the highest REF for their electricity use.</p> <p>The Renewable Energy Factor (REF) for energy supplied and consumed in the data centre shall be calculated according to EN 50600-4-3.</p> <p>The electricity contributing to the REF must come from renewable sources as defined by Directive 2009/28/EC.</p> <p>Verification:</p> <p>The REF and the electricity supply and usage data on which the calculations are based shall be declared.</p> <p>Relevant documentation from a Guarantee of Origin Scheme shall be submitted. Alternatively, any other equivalent proof shall be accepted.*</p> <p><i>* Please see the Explanatory note for further information.</i></p>

Criterion 3.1: Renewable energy factor

1st criteria proposal

CONTRACT PERFORMANCE CLAUSES	
	<p>CPC1.1 Renewable Energy Factor</p> <p><i>To be included when the data centre is operated by a third party.</i></p> <p>The operator of the data centre facility shall provide monthly data for the renewable energy purchased and the total metered energy consumption of the data centre.</p>
EXPLANATORY NOTE	
<p>Guarantee of Origin:</p> <p>All EU countries are legally obliged, under Directives 2009/28/EC and 2004/8/EC, to set up Guarantee of Origin schemes for electricity from renewable energy sources. These provide a good legal basis for verification. Please note that the current state of mandatory application of Guarantee of Origin schemes may vary between member states.</p> <p>An alternative would be for the supplier to provide independent proof of the fact that a corresponding quantity of electricity has been generated from so-defined renewable sources (e.g. a tradable certificate from an independent issuing body, which has been approved by government ²⁹). Another alternative would be if the electricity supplied carried a Type-1 ecolabel with a definition at least as strict as that in Directive 2009/28/EC.</p>	

Criterion 3.1: Renewable energy factor

Stakeholder comments

- In general, stakeholders agreed that **renewables are an important factor to consider** and should be included even if just to raise awareness
- Many comments addressed **the importance of additionality** but also recognised the difficulty in demonstrating this.
- The use of **GOs and other independent eco-labels** were encouraged
- Some requested that DC sites that support **direct new investment** should be rewarded
- but there was concern about the **practicality** of doing so.
- Matching renewables generation to the **actual demand profile** was recommended and should be rewarded.
- There were concerns that **use of PPAs would limit the applicability to larger DC sites** since this was not part of the core business.

Criterion 3.1: Renewable energy factor

Background research and follow-up

- A few Member States have a [high renewable energy content](#) and there is little potential to act through the GO mechanism
- In practice, [on site renewables](#) can only supply a small fraction of the total data centre energy consumption.
- Sites which meet both the [data centres network and access requirements](#) (generally close to major cities and to a sufficiently capable power grid) as well as being [suitable for significant sized renewables](#) that could potentially be located near to the site are likely to be limited.
- There are limited data centres publicly reporting their use of renewables, and fewer still using PPAs or on-site technology.
- For smaller data centres, it may be possible to join [consortia to sign PPAs](#) e.g. Akzo Nobel, DMS, Philips and Google purchasing from a wind farm in The Netherlands
- [Public authorities](#) are starting to use PPAs to support subsidy free investment in solar PV capacity

Criterion 3.1: Renewable energy factor

Discussion points

- Member State renewables threshold of <20% recommended for using the core REF criterion
- Introduction of option to reward on/near site direct connections and supply that maximise load matching
- Energy service or PPA arrangements as the basis for the direct supply of electricity

Criteria 2.3.2: Use of refrigerants and their GWP

1st Criteria Proposal

Core criteria	Comprehensive criteria
AWARD CRITERIA	
	<p>AC1.2 Facility greenhouse gas inventory</p> <p><i>This criteria is only appropriate for the procurement of a whole new data centre facility.</i></p> <p>Points shall be awarded in proportion to the bidder that offers the lowest greenhouse gas emissions per year operation of the project.</p> <p>Bidders shall estimate the greenhouse gas emissions for one year's operation of their data centre design according to the contracting authorities technical specification.</p> <p>The emissions shall be compiled in accordance with EN ISO 14064-2 or equivalent. The boundary for emissions from the project shall comprise direct, indirect and carbon leakage related emissions..</p> <p>Verification:</p> <p>The assumptions upon which estimation of the emissions are based shall be provided. They shall be validated by a third party independent assessment in accordance with the principles and requirements of ISO 14064-3.</p>
CONTRACT PERFORMANCE CLAUSES	
	<p>CPC1.2 Project greenhouse gas inventory</p> <p><i>To be included if criterion AC1.3 is used.</i></p> <p>The operator of the data centre project shall monitor and verify the project emissions as estimated at bid stage.</p> <p>The actual monitored emissions shall be reported for each year of operation, based on metered energy consumption with the possibility for third party verification if requested.</p>

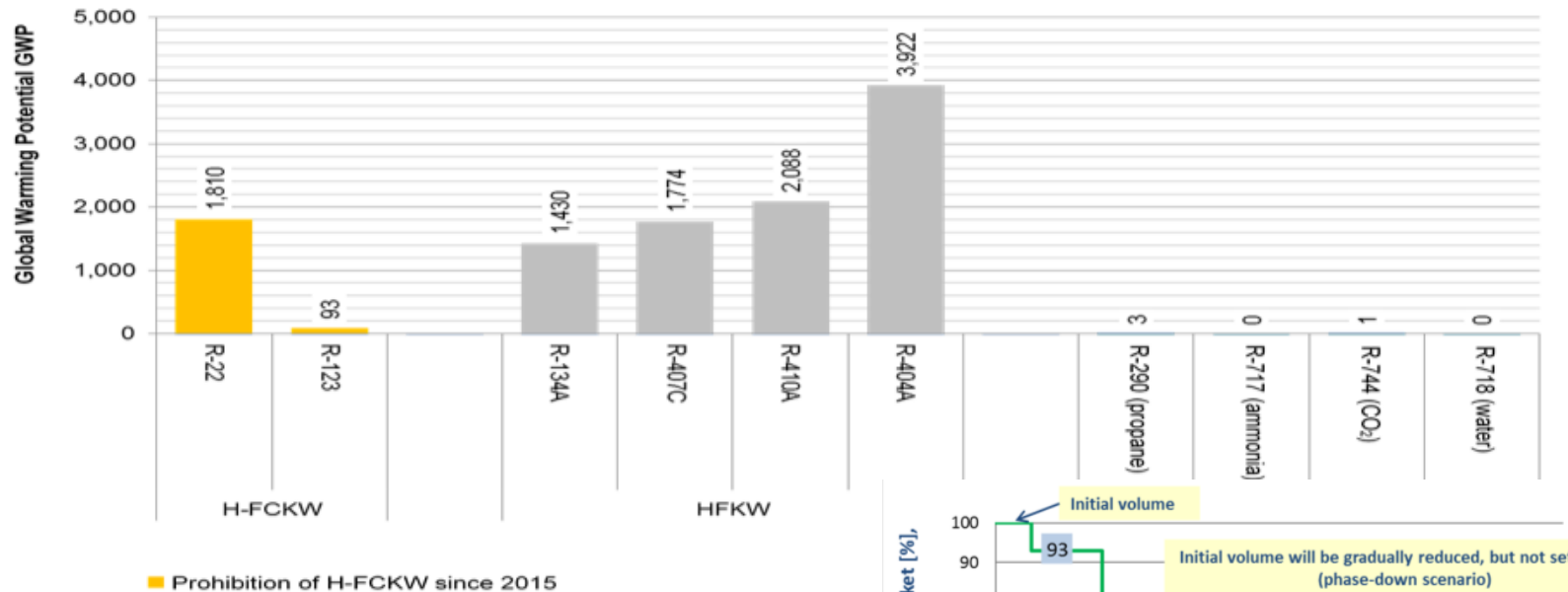
Criteria 2.3.2: Use of refrigerants and their GWP

1st Criteria Proposal

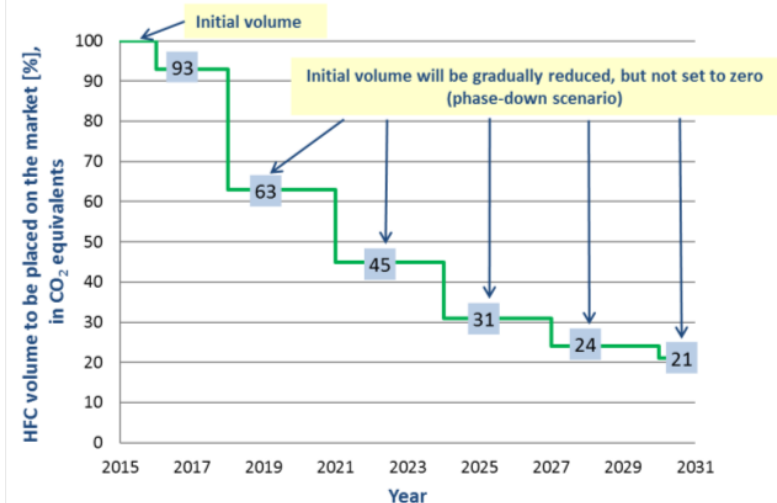
- questioned the **cost** and **practicality** of providing a **GHG inventory** as proposed in the first draft of these criteria.
- **no added value** was (energy use and renewable energy already covered by other criteria)
- In case a criterion is included it should focus on the **operational phase** and **keep as simple as possible**
- GHG effect of potential leakage **of some F-Gas refrigerants** is large.
- F-Gas Regulation **phases down** (not out) the use of these gases.
- Additionally, a criterion on the potential GHG effect of these gases can incentivise the use cooling systems **not relying on refrigerants**.

Criteria 2.3.2: Use of refrigerants and their GWP

Background research and follow-up



**EU F-Gas-Regulation
(Regulation (EU) No 517/2014)**



Criteria 2.3.2: Use of refrigerants and their GWP

2nd Criteria Proposal

Core criteria	Comprehensive criteria
AWARD CRITERIA	
<p>AC3.2.1 Global warming potential of mixture of refrigerants Points must be awarded in proportion to the tenderer that offers the lowest global warming potential weighted average for the mixture of refrigerants that will be used calculated according the Annex IV of Regulation (EU) No 517/2014.</p> <p>Verification: Tenderers must report the calculation of the global warming potential weighted average, including the technical specifications of the refrigerants used, and show consistency with the method described in Annex IV of Regulation (EU) No 517/2014.</p>	
CONTRACT PERFORMANCE CLAUSES	
	<p>CPC3.2.1 Global warming potential of mixtures of refrigerants <i>To be included if criteria AC1.2 is used.</i> The operator of the data centre project must monitor and verify the cooling system's GHG of refrigerant emissions as estimated at bid stage. The actual monitored emissions must be reported for each year of operation, based on metered energy consumption with the possibility for third party verification if requested.</p>

Criteria 2.3.2: Use of refrigerants and their GWP

Discussion points

- More specific focus now on **refrigerant GWP**
- Are **alternative refrigerants** sufficiently well established in the market?
- Could it be applicable to **existing cooling plant**?

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Procurement Practice Guidance for Data Centres

30th May 2018



Procurement Practice Guidance for Data Centres

The proposed guidance aims to:

- provide **simplified guidance** to procurers and project teams on how to procure an environmentally improved data centre
- **focus** on the potential for **consolidation** of existing distributed server rooms into new data centres
- reflect the **key steps** in a generic process of consolidation and procurement, as well as the associated project activities that may be involved.

Procurement Practice Guidance for Data Centres

Main sources identified:

- *CLC-TR50600-99-1: Recommended Practices for Energy Management*
- *(JRC 2018) Best Practice Guidelines for the EU Code of Conduct on Data Centre Energy Efficiency*
- *(EC 2016) Buying green! A handbook on green public procurement 3rd Edition*
- *(JRC 2016) Best Environmental Management Practice (BEMP) in the Telecommunications and ICT Services Sector*
- *(Schneider Electric, 2016) 5 Steps to a Successful Data Center Consolidation*

Procurement Practice Guidance for Data Centres

STEP 1: Scoping

Involvement of Key Stakeholders

- ✓ Establish a group containing internal representatives from all disciplines
- ✓ External expertise as part of internal team

Needs assessment

- ✓ Audit existing physical estate and services
- ✓ Analyse the utilization patterns
- ✓ Audit of existing ICT environmental requirements

Location and physical layout

- ✓ Analyse the climatic conditions (temperature and humidity)
- ✓ Opportunities for near-site / on-site renewable energy
- ✓ Analyse the opportunities for the reuse of waste heat
- ✓ layout of the building does not obstruct or restrict free cooling



Procurement Practice Guidance for Data Centres

STEP 2: Tender process

Procurement routes

- ✓ Evaluate the potential environmental benefits of alternative routes (e.g. cloud managed services)

Market dialogue

- ✓ Engage in dialogue with potential suppliers prior to tendering (e.g. by a Prior Information Notice (PIN), publishing information on your website, or holding an information day for interested suppliers).

Tender procedure

- ✓ Select the procedure that fits your need (e.g. open procedure, restricted procedure, Innovation Partnership)

Tender evaluation

- ✓ Evaluation committee, interaction with bidders (where permitted)



Procurement Practice Guidance for Data Centres

STEP3: Contract execution

Concept Design

- ✓ Define appropriate resilience level
- ✓ Define appropriate IT Capacity, Growth Plan, Density

Detailed Design

- ✓ Implementation of Best Practices

Operation and Monitoring

- ✓ Data centre infrastructure management (DCIM) and Energy Management Control System



Procurement Practice Guidance for Data Centres

STEP4: Decommissioning

Decommissioning / End of Life

- ✓ Decommission and remove any ICT equipment supporting unused services
- ✓ Develop a replacement strategy (lifetime optimization).



Procurement Practice Guidance for Data Centres

Step	Description	Actions	Supporting information
Involvement of Key Stakeholders	<p>Ineffective communication between the disciplines working directly and indirectly in the data centre is a major driver of inefficiency as well as capacity and reliability issues (CLC-TR50600-99-1 / EU Code of Conduct for data Centres).</p> <p>Specific issues in a consolidation process</p> <p>Before diving into planning and designing a consolidation, data centre professionals must get input from business leaders and departmental managers in the enterprise about what they hope to achieve through consolidating as well as what different business units require for computational power, continuity, storage, back-up, and future capacity. (Schneider Electric, 2016. 5 Steps to a Successful Data Center Consolidation)</p> <p>Implications of a data centre consolidation, including any necessary changes in processes or organizational structure must to be considered. (Schneider Electric, 2016. 5 Steps to a Successful Data Center Consolidation)</p>	<p><u>What can be done in practice?</u></p> <p>Establish a group containing representatives from all disciplines (software, ICT equipment, mechanical, electrical and procurement) for the approval of any significant decision to ensure that the impacts of the decision have been properly understood and an effective solution reached. This group could be seen as the functional equivalent of a change board. (CLC-TR50600-99-1 / EU Code of Conduct for data Centres)</p>	<p>Examples/ case study.</p> <p>Or</p> <p>Technical guidance note</p>

Guidance inputs and sub-group

- Draft structure to be circulated shortly after the meeting
- Call for interest in participating in a subgroup
 - Possible phone meeting later in June / July
- Send us relevant examples from the sector

Concluding remarks and next steps

Written comments on the first criteria proposals are invited and should be posted on the BATIS system **at the latest by Wednesday 27th June 2018**

Thank you for your attention

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