The European Commission's science and knowledge service

Joint Research Centre

EU GPP criteria for DATA CENTRES

1st Ad Hoc Working Group Meeting

Seville - 16th November 2017

European Commission

EU Green Public Procurement (GPP) Policy

European Commission
Environment Directorate-General
Enrico Degiorgis

What is GPP?

"...a process whereby **public authorities** seek to procure goods, services and works with a **reduced environmental impact** throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured."

EU Green Public Procurement Policy

GPP Benefits

Decreasing GHG and hazardous substances, increasing resource and energy efficiency…

Environmental

Increasing uptake of green technologies and products, supporting innovation…

Social

GPP

14% of GDP

Economic

Improving health and well-being…

Political

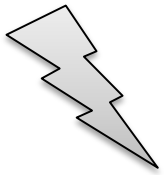
Achieving environmental obligations, showing commitment to environment protection and sustainable consumption and production…

GPP legal framework

- Directive 2014/24/EU on public procurement (repealing Directive 2004/18/EC)

Obstacles to GPP

- Green products are perceived to cost more
- Lack of knowledge on how to verify green criteria
- Lack of awareness of the benefits of green products
- Lack of professional workforce + time



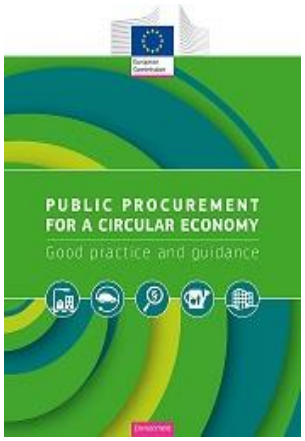
Commission support

EU Green Public Procurement Policy

GPP support tools

GPP website of the European Commission:

- *Full sets of EU GPP criteria and background reports in 20+ languages*
- Buying Green Handbook
- Circular Procurement brochure NEW!
- More than 100 GPP Examples
- News and upcoming events



HELP DESK:

In EN, FR, DE ***gpp-helpdesk@iclei.org***

Newsletter (please sign up!)

Green Public Procurement in Circular Economy Action Plan

- *Key role for circular economy acknowledged*
- *Special emphasis on circular economy aspects in criteria-setting (durability, reparability)*
- *Support a greater uptake of GPP criteria by public authorities, e.g. by training*
- *Commission to lead by example - in its own procurement, and by reinforcing the use of GPP in EU funding*

Two levels of criteria

Core criteria:

- Aim at addressing the key environmental impacts
- Require minimum additional verification effort or cost increases

Comprehensive criteria:

- Aim at purchasing the best environmental products available o the market
- possibly requiring additional verification efforts or a slight increase in cost compared to other products with the same functionality.

GPP criteria are largely based on standard Type I ecolabels.
It is however not allowed to ask for products to have a specific label.

EU Green Public Procurement Policy

Questions? Please contact:

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GPP webpage: http://ec.europa.eu/environment/gpp

The European Commission's science and knowledge service

Joint Research Centre

EU GPP criteria for DATA CENTRES

INTRODUCTION AND BACKGROUND

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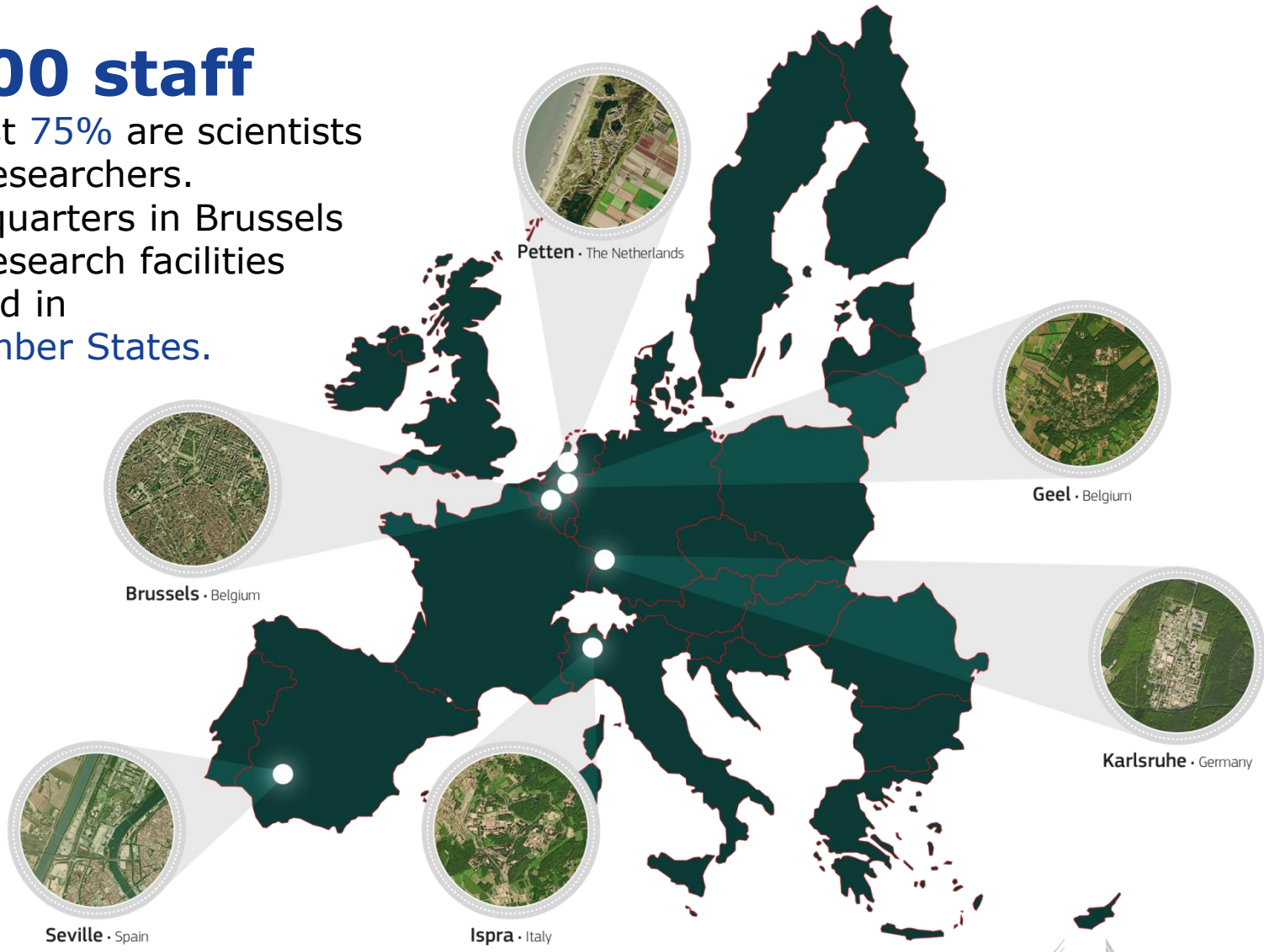
The Joint Research Centre at a glance

3000 staff

Almost 75% are scientists and researchers.
Headquarters in Brussels and research facilities located in
5 Member States.



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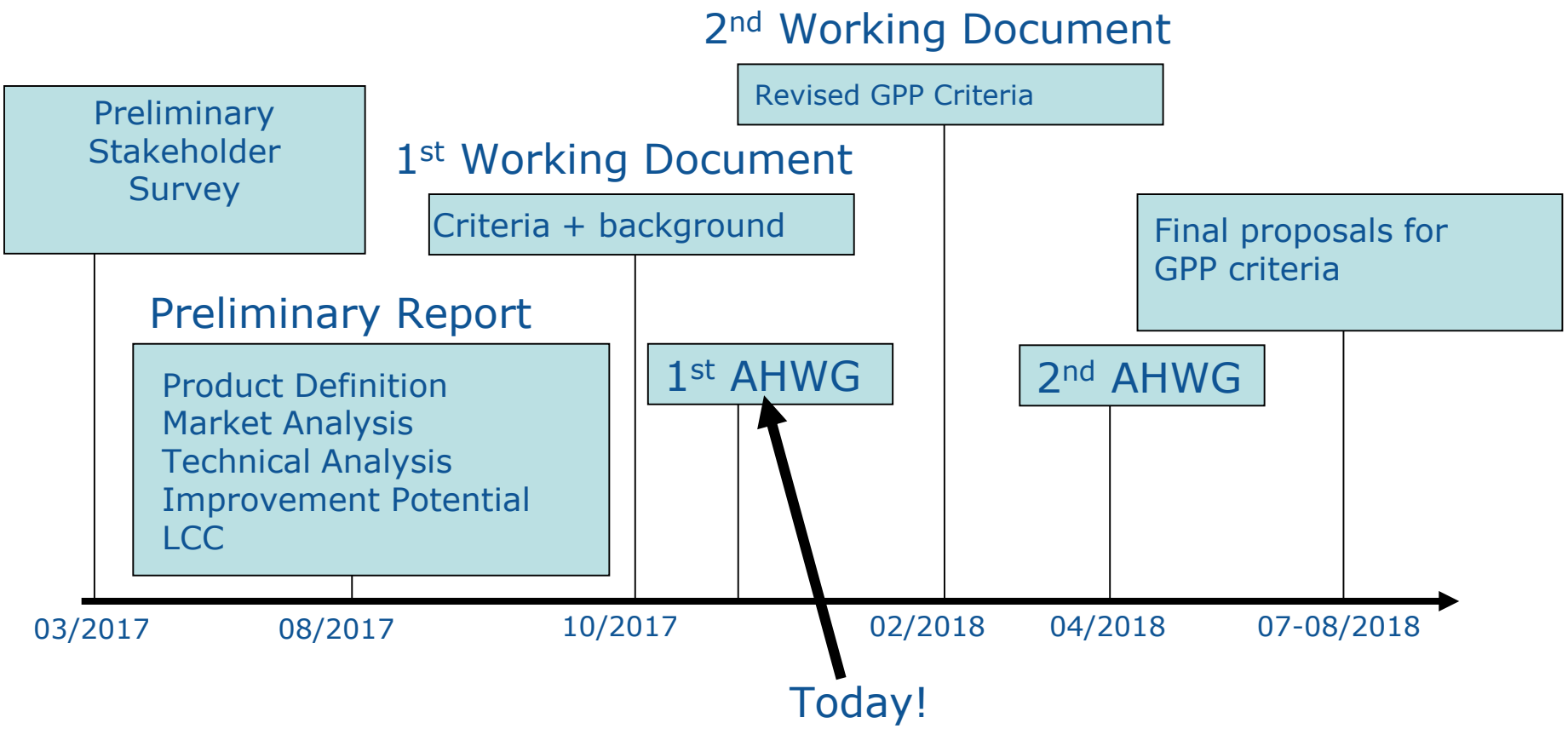
Work Programme and Timeline



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Preliminary Stakeholder Survey March – April 2017

Number	Organisation type
13	Consultant and/or research institution
1	Laboratory testing organisation
8	Manufacturer of IT products for the data centres (e.g. servers, network, storage, cabling)
3	Manufacturer of the electrical system of the data centres (e.g. UPS, transformers, generators, lights)
4	Manufacturer of the mechanical system of the data centres (e.g. compressors, fans, pumps)
6	Non-governmental organisation (NGO)
4	Public procurer from a local, regional, national or continental authority
11	Supplier of services for data centres (e.g. colocation services, managed service providers, operators, maintenance providers, building contractors)
2	Trade associations and professional bodies

- Need to involve a larger group of public authorities
- Case studies and contacts are requested

Publication of the technical background documents and first criteria proposals
Criteria and metrics to be included in the GPP criteria

Date	Description	Link
25/10/2017	Overview of first draft criteria proposals (v1.0)	Overview v1.0
25/10/2017	Technical Background Report with first draft criteria proposals (v1.0)	Technical report v1.0
25/10/2017	Preliminary Background Report (v1.0)	Preliminary Background Report (v1.0)

Authors:

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- Larisa Maya-Drysdale, Baijia Huang, Jan Viegand (Viegand Maagøe)
- Sophia Flucker, Robert Tozer (Operational Intelligence)
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- Anson Wu (Hansheng)

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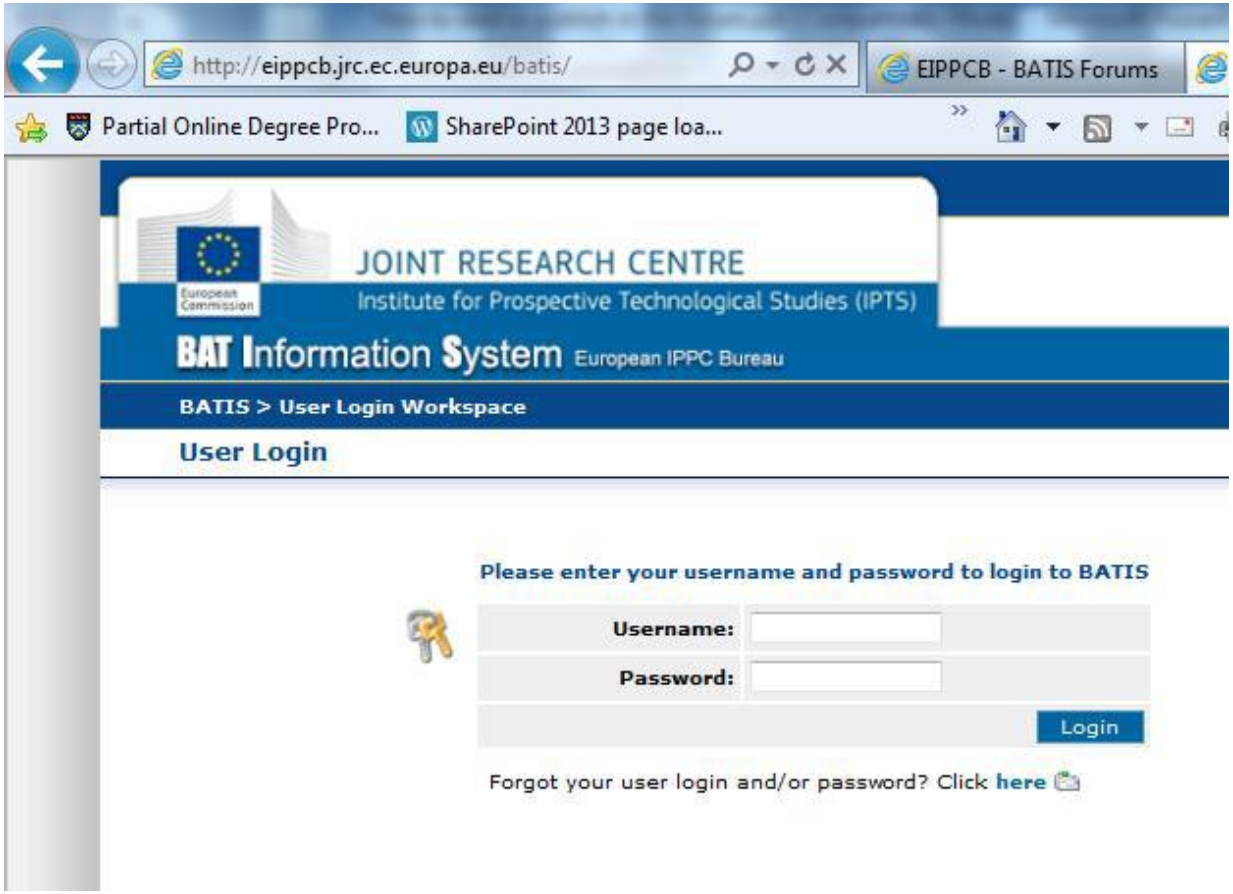
Comments using the BATIS system

Written comments on the first criteria proposals are invited and should be posted on the BATIS system **at the latest by Friday 8th December 2017**



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Preliminary findings 1 – Scope, Market and Procurement models

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Presentation and discussion on procurement routes and scope definition

Background for the definition of a data center

- EU Code of Conduct
- NACE (Nomenclature Générale des Activités Économiques dans les Communautés Européennes)
- EU Standards (Information technology - Data centre facilities and infrastructures - Part 1: General concepts)
- Interviews with experts

Preliminary Stakeholder Survey
Proposed scope and definitions

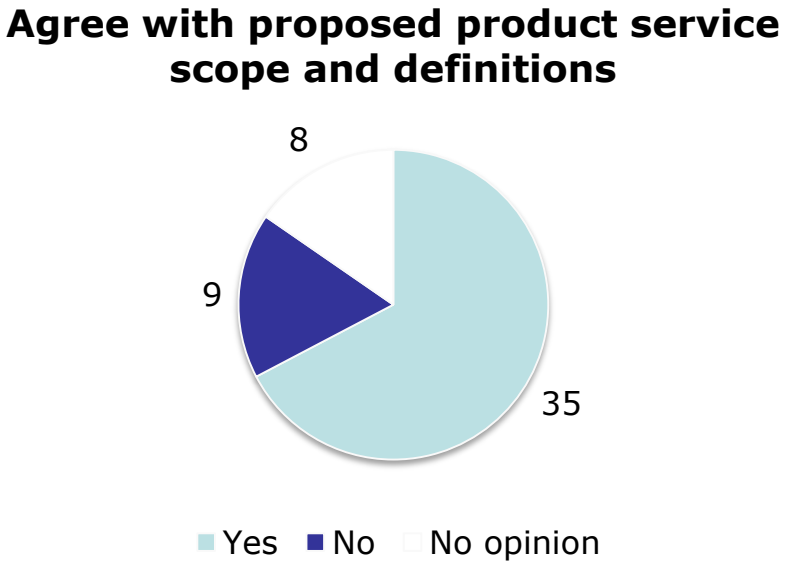
"A data centre means all buildings, facilities and rooms which contain servers, data storage equipment, network equipment, UPS equipment, cooling equipment, power delivery equipment and monitoring equipment and provide data services such as hosting, data processing and related activities.
The purchase of the data services can be provided by one of the following data centre types (with their definitions):

- **Enterprise** (Users have own dedicated facility. Scale varies.)
- **Colocation** (Physical infrastructure provided usually up to rack level. Customers manage their own servers and data storage.)
- **Managed Service Provider (MSP)** (Cloud services where customer pays for service and vendor provides and manages required IT hardware/software)
- **Hyper-scale** (Service provider is also equipment customer. Sells services to others.)

Each of these data centre types can provide different levels of reliability which, according to Uptime Institute's Tier classification, they can be classified as Tier I, Tier II, Tier III and Tier IV

Preliminary Stakeholder Survey
Stakeholders' opinion on proposed scope and definitions

- Positive feedbacks for the proposed definition
- Main issue raised was about the mentioning of the Uptime Tiers.



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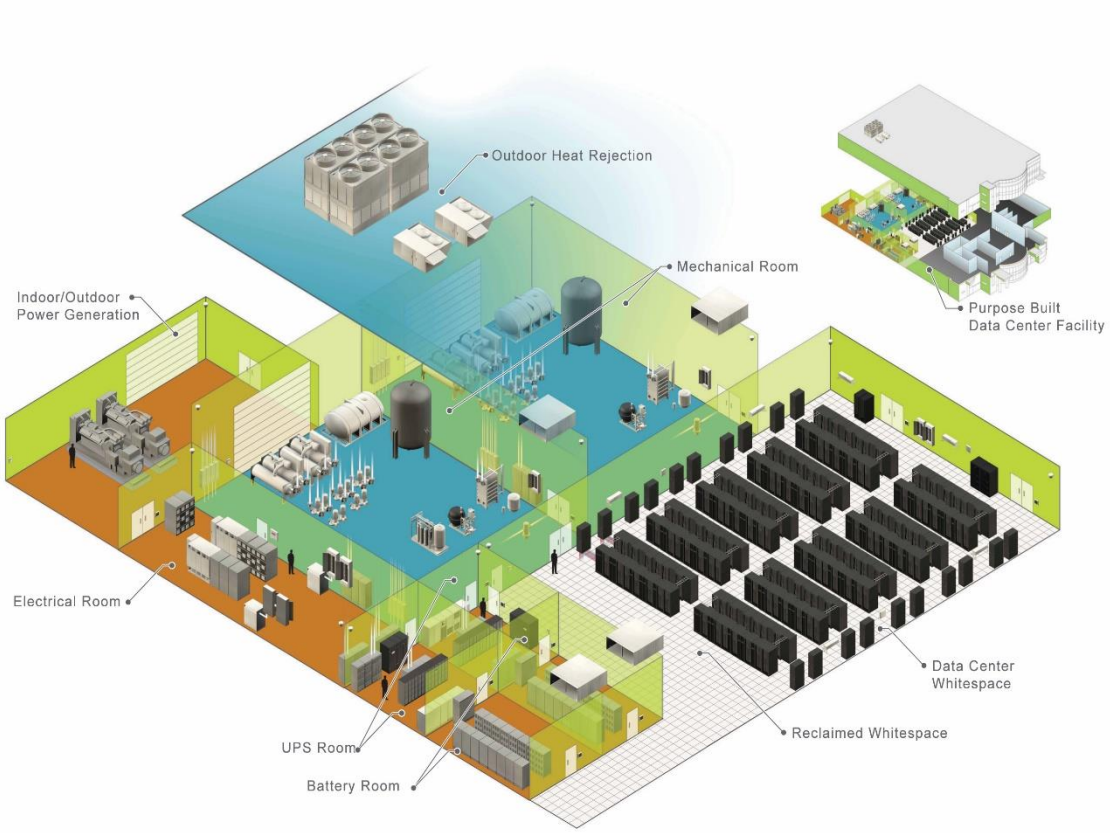
Proposed definition of Data Centre



Data centre definition

Data centre means a structure, 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.

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Proposed classification of data centres

Data centre type	Description
Enterprise	A data centre that is operated by an enterprise which has the sole purpose of the delivery and management of services to its employees and customers.
Colocation	A data centre facility in which multiple customers locate their own network(s), servers and storage equipment.
Managed Service Providers (MSP)	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).

Proposed data centre 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 space;
- **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.

Market Share - EU total data centres in square meters of white space

Source: Data Center Dynamics

Market	Enterprise	Colocation	Managed Service Provider
Austria	52500	22100	2200
Belgium	61500	31900	3700
Bulgaria	32550	13700	1500
Croatia	19350	17500	1320
Cyprus	10800	11000	800
Czech Republic	31500	19200	1050
Denmark	36000	40300	3600
England	772500	474500	24000
Estonia	13200	8100	1000
Finland	48750	83200	8900
France	577500	305500	21000
Germany	825000	409500	27900
Greece	41250	29900	2600
Hungary	30900	31900	2400
Ireland	43500	188500	10300
Italy	201000	84500	5700
Latvia	30750	12800	300
Lithuania	50250	21000	2050
Luxembourg	15300	62400	5100
Malta	12900	11700	700
Netherlands	210000	351000	15800
Poland	70500	61100	2400
Portugal	33000	16900	1200
Romania	40500	17200	1200
Slovakia	34500	14600	640
Slovenia	15750	9700	700
Spain	270000	136500	14600
Sweden	48000	75400	8000
Total	**3629250**	**2562000**	**170660**
% of total	**57%**	**40%**	**3%**

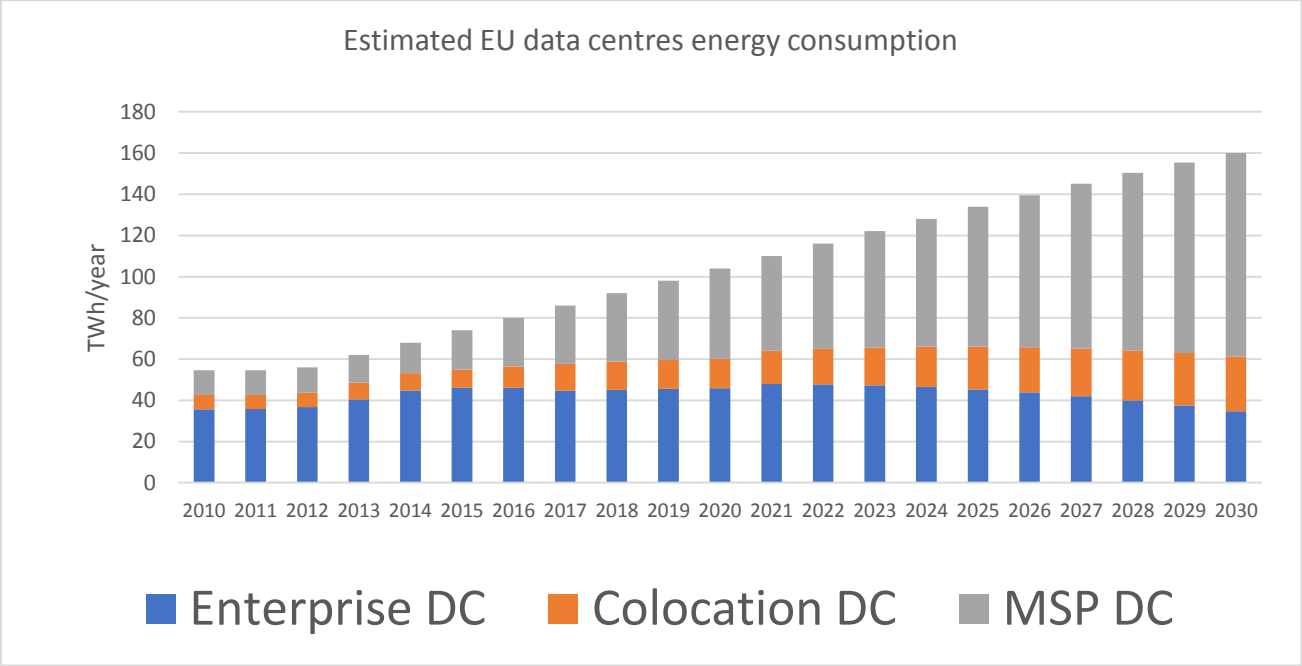
Estimated number of EU total data centre facilities

Source: Data Center Dynamics

Market	Enterprise	Colocation	Managed Service Provider
Austria	330	60	4
Belgium	345	65	6
Bulgaria	265	20	2
Croatia	160	15	1
Cyprus	90	15	0
Czech Republic	450	40	2
Denmark	680	40	5
England	11500	450	25
Estonia	135	10	1
Finland	220	35	4
France	8700	270	20
Germany	13200	410	30
Greece	330	20	2
Hungary	260	15	1
Ireland	350	40	2
Italy	6500	95	7
Latvia	160	20	0
Lithuania	220	10	0
Luxembourg	115	25	3
Malta	80	10	0
Netherlands	5600	250	15
Poland	1600	70	3
Portugal	275	25	2
Romania	650	30	2
Slovakia	260	15	0
Slovenia	140	10	0
Spain	6300	100	10
Sweden	1300	50	5
Total	**60215**	**2215**	**152**
% of total	**96.2%**	**3.5%**	**0.3%**

Market Trends

- Based on different data sources the estimated energy consumption of data centres in the EU was established, as well as projected consumption up to 2030



- There is a general trend towards managed service providers in the private sector

Market Trends in the public sector

Enterprise data centres:

- The public sector is more conservative so the amount of white space serving public authorities may still be greater within enterprise data centres
- legacy equipment will always exist since some services are too sensitive, complex or expensive to decommission.

Cloud services:

- increasing example of public facing cloud services delivered by mega data centres
- counter pressure due to data security issues and public acceptance.

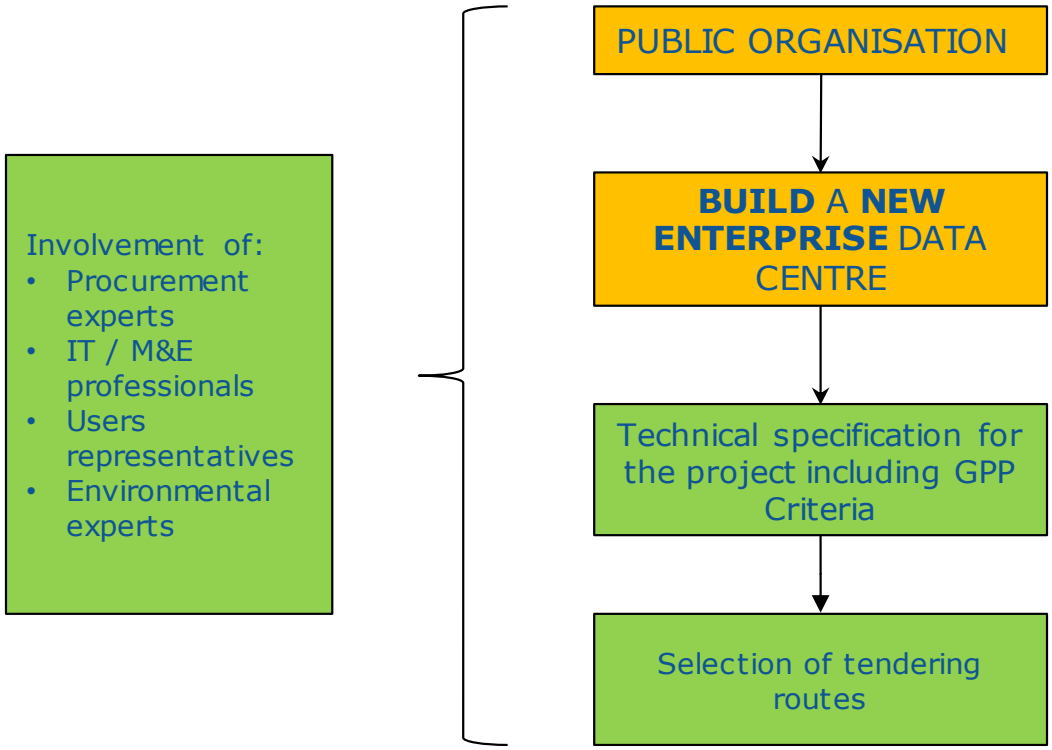
Procurement routes in the public sector

The identified routes for the public procurement of data centres, have been established from initial information collected from:

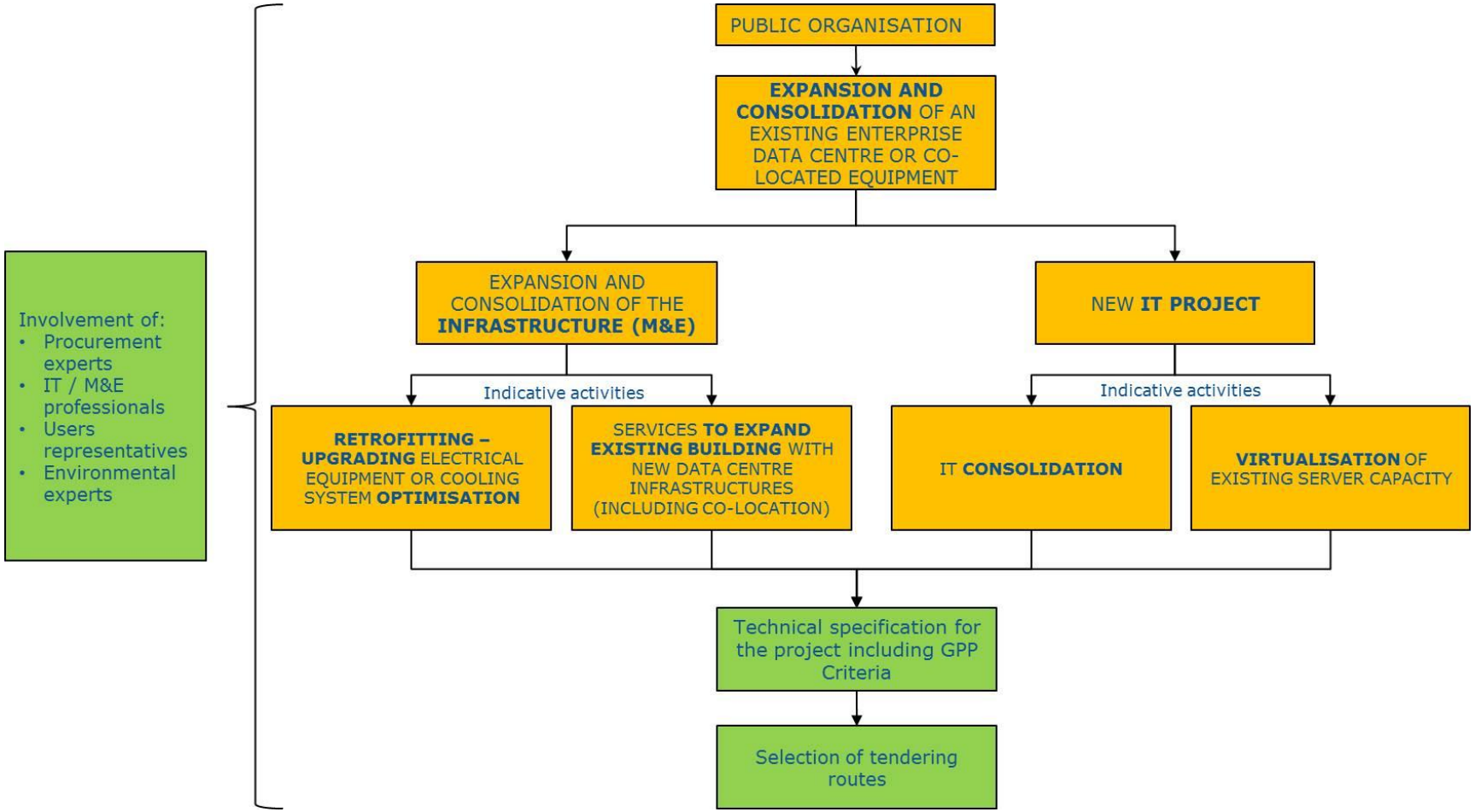
- the EURECA project team (https://www.dceureca.eu/)
- other identified examples of procurement practices in the EU.

These are only preliminary findings and further inputs for the description of procurement routes are welcomed.

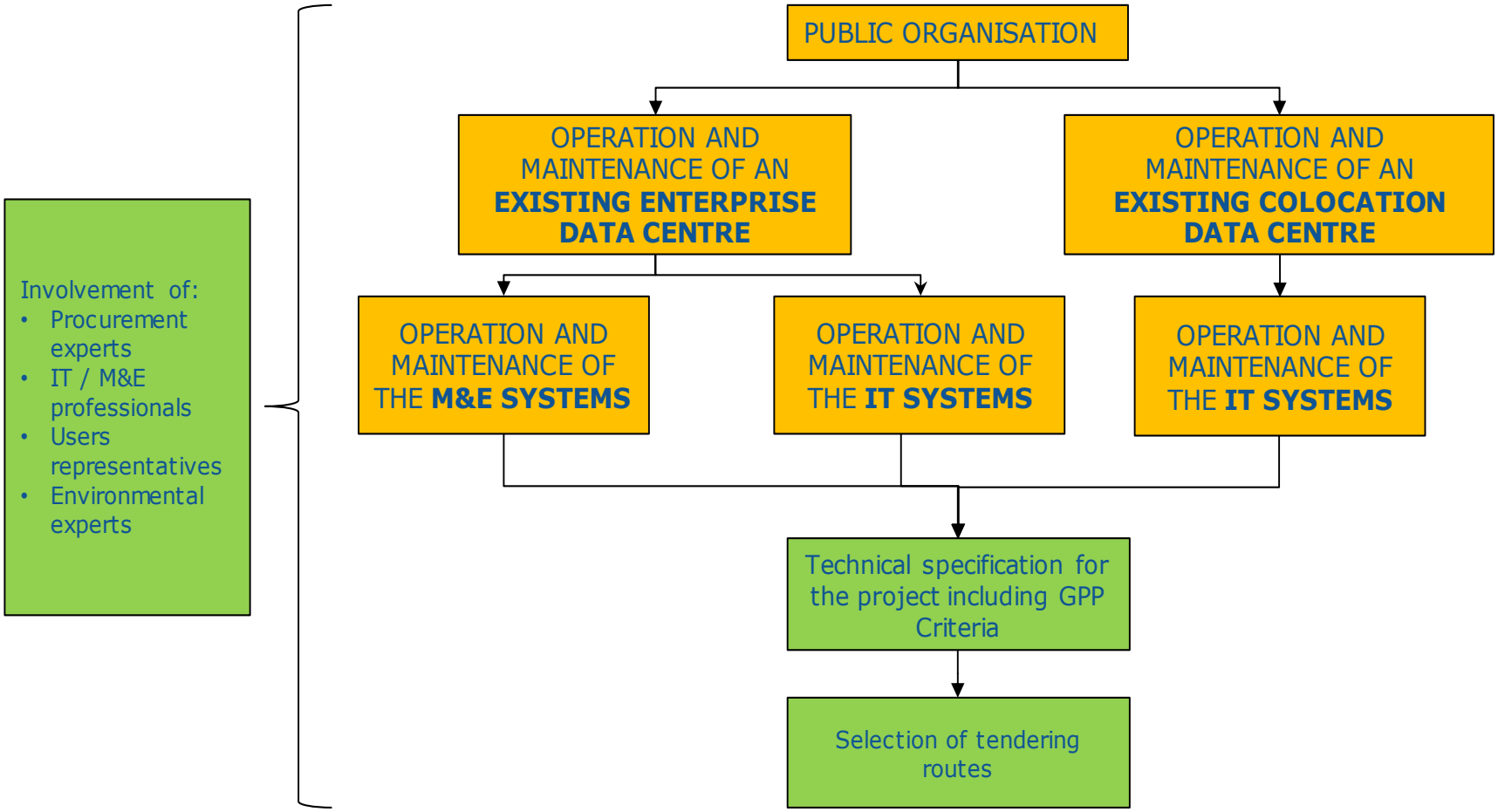
Building a new data centre



Expansion and consolidation of the infrastructure or a new IT project



Operation and Maintenance



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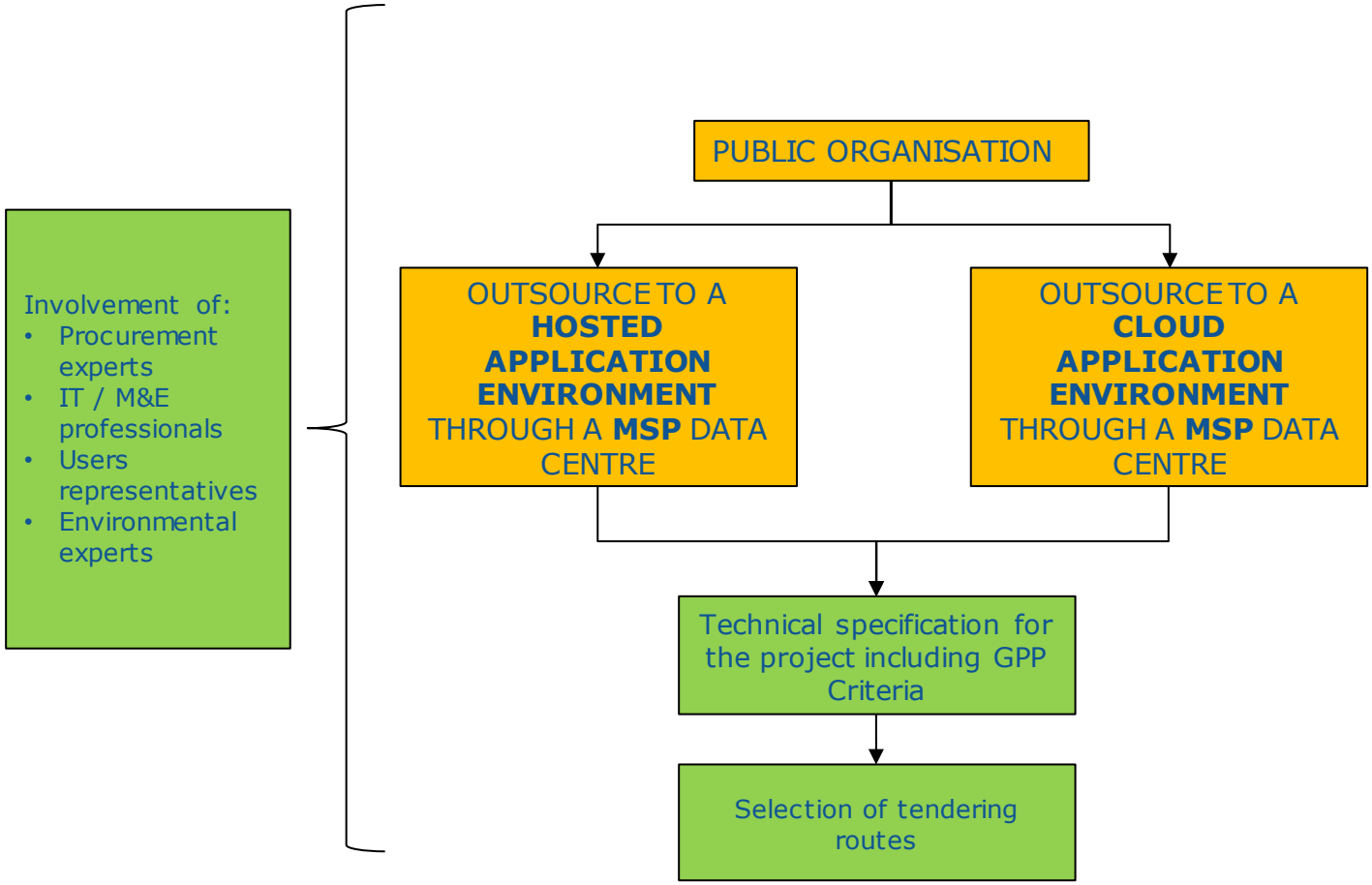
Outsource to a hosted or Cloud application



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Identified procurement scenarios: Overview

1. Building a new data centre	
2. Expansion and consolidation of the infrastructure or a new IT project	a. retrofitting such as upgrading electrical equipment or cooling system optimisation b. consolidating existing data centres estates c. virtualisation of existing server capacity d. services to expand existing building with new data centre infrastructure
3. Operation and/or maintenance of the facility	a. specification of data center operational requirements, b. arrangements to locate and/or operate your IT equipment from within a colocation data centre
4. Outsourcing to a hosted and/or cloud application environment, which means procuring a service and not a physical product	

Scope, Market, Procurement
Questions

- Are the scope and definitions appropriate?
- Is our picture of the market representative?
- Are the identified procurement routes representative?

Specific points/requests:

– More knowledge of public procurements trend and routes needed

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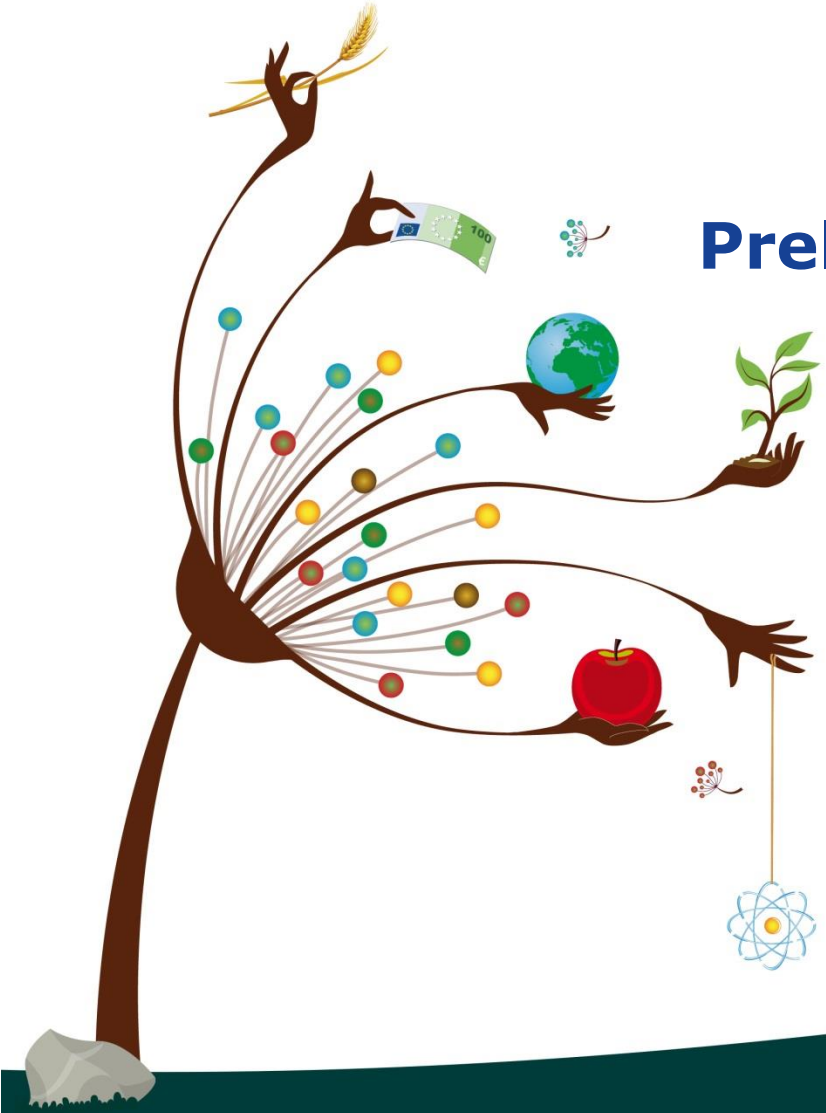

Preliminary findings 2: LCA and LCC analysis, standard and metrics, technical improvement potential.

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The life cycle of a data centre: Subject of the studies

Representative product groups, sub-categories, technologies or specifications

- **10** LCA studies analysed
- **7 of 10** LCA studies assessed the whole life cycle of data centres
- **1** assessed servers and storage,
- **1** only servers
- **1** a specific cooling technology

The life cycle of a data centre

Time and Geographical scope

- In average the time scope of the studies is **2013** (1 covering 2015, 2 – 2014, 3 – 2013, 2 – 2012, 1 – 2010, 1 – 2009, 1 – 2007)

- Geographical coverage: mainly Europe and US

Comprehensiveness:

The environmental impacts assessed varied widely across the ten studies,

- 10 of 10 looking at Global Warming Potential (GWP) 100 years
- 7 of 10 looking at other environmental impacts beyond Climate Change

The life cycle of a data centre: Robustness and reliability

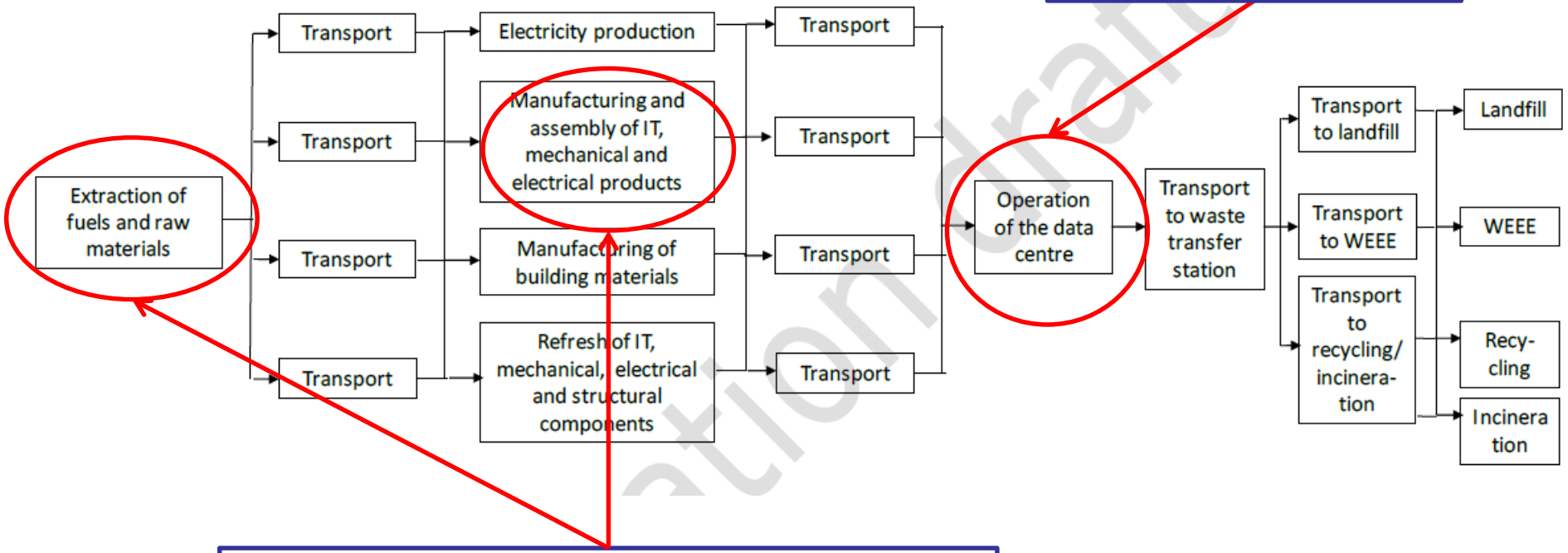
- Due to the limited number of LCA studies for data centres, it was not possible to only show results from studies following entirely the ISO 14040/44 standards and/or the PEF methodology.

- Some of the studies did not present information on important methodological aspects like when allocation or system expansion were applied, nor on the cut-off applied nor used environmental impact categories nor end of life modelling principles recommended by PEF.

- This is because the use of LCA is relatively new for data centres, and the diversity of methodologies applied is quite wide considering the limited number of LCA studies. Furthermore, the data centre systems are rather complex, bringing together several pieces of equipment.

The life cycle of a data centre: hotspots

The use stage due to the electricity consumption, first by the IT system and second by the M&E system



The manufacturing of the IT system and M&E system and in particular due to the disposal of waste arising from the mining, extraction and refining of metals used to manufacture printed circuit boards of IT components.

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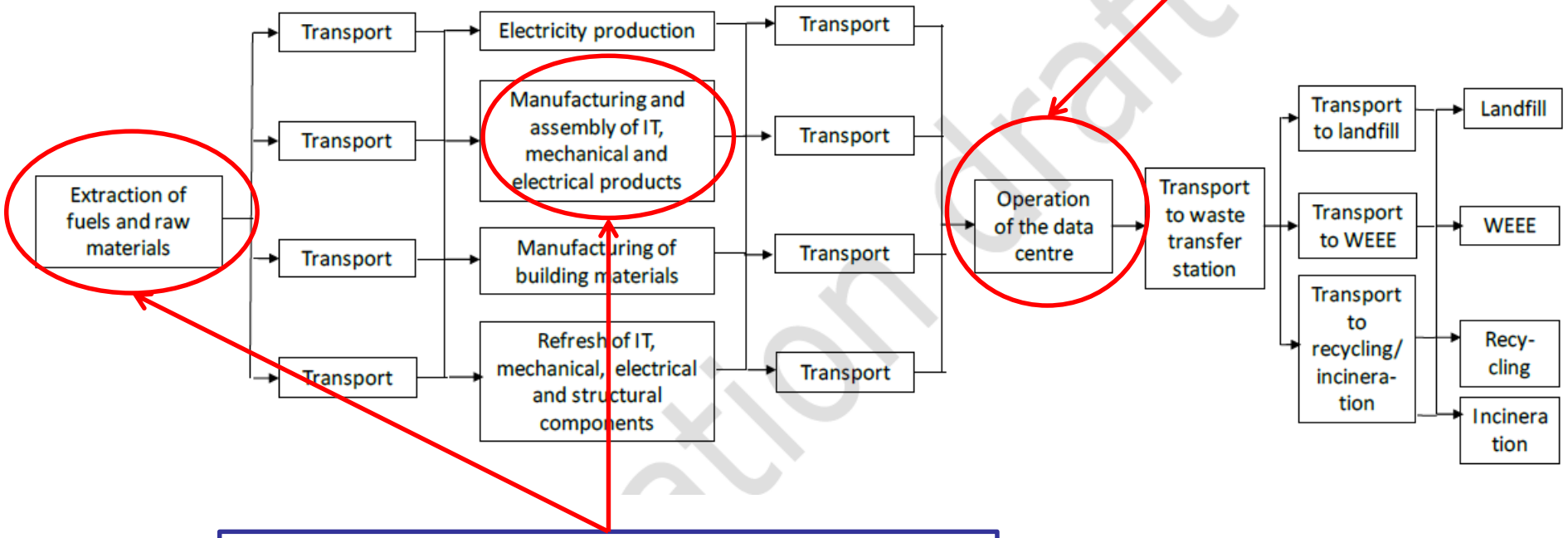
The life cycle of a data centre: impacts

1. Global warming potential
2. Acidification
3. Eutrophication
4. Primary energy demand



1. Global warming potential
2. Toxicity, both human toxicity and ecotoxicity
3. Resource depletion, focusing on mineral resources

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The life cycle of a data centre: impacts

The life cycle assessment of data centres has indicated that the main environmental impacts stem from the IT and cooling systems, in particular from:

- The **energy mix** used to supply electricity, which can be greatly reduced
- The **energy consumption** and related energy efficiency of the overall data centre including IT and the mechanical and electrical (M&E) systems, which determines the amount of energy consumption.
- The **manufacture** (incl. raw materials extraction and transport) of the IT and M&E systems, and in particular due to the disposal of waste products from the extraction and refining of metals used to manufacture printed circuit boards of IT components

The **end of life** of the equipment, specially focusing on the possibilities for reuse and recycling that are alternative to other routes and that can avoid some of the environmental impacts from manufacturing.

Life Cycle costing

- Input provided by industry experts during interviews in July 2017
- The assessment has been done qualitatively as a starting point, with a quantitative range estimation

The analysis includes:

- An overview of the relative costs ranges between the different data centre types
- A distinction between operative expenditures and capital expenditures
- A distinction between costs for the facility (M&E and building infrastructure) and costs for the IT system
- An analysis of differences between the costs for data centre owners and those to customers

Life Cycle costing

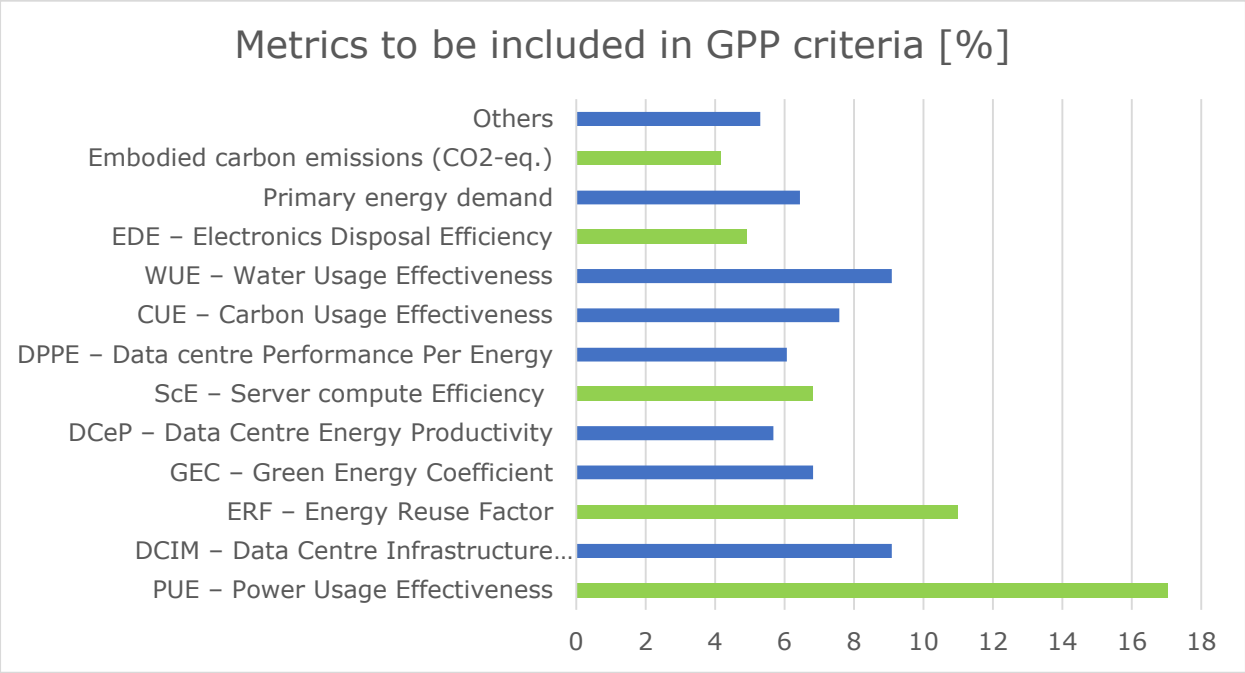
- CAPEX refers to the purchase and installation of the IT, mechanical and electrical equipment in the building, together with the building infrastructure.
- OPEX refers to the running costs
- Decommissioning refers to switching down the facility once it reaches its end of life, and the end-of-life costs are related to disposal, recycling and WEEE treatment.

Cost category	Cost range for DC owners			Cost for DC customers		
	Enterprise	Colocation	MSP	Enterprise	Colocation	MSP
CAPEX facilities	15-20%	40-50%	15-20%	15-20%	1-5%	0%
CAPEX IT	30-40%	1-10%	30-40%	30-40%	35-45%	0%
OPEX facilities	10-15%	35-45%	10-15%	10-15%	15-20%	35-50%
OPEX IT	25-35%	1-10%	25-35%	25-35%	30-40%	50-70%
Decommissioning	5-10%	1-5%	1-5%	5-10%	1-5%	0%
Facilities end of Life	1-5%	1-2%	1-2%	1-5%	N/A	N/A

Relevant initiatives considered in the development of the proposed criteria

- Ecodesign for Enterprise servers and data storage equipment (under development)
- EU Code of Conduct (CoC) for Energy Efficiency in Data Centres
- The Green Grid voluntary standards and models
- EURECA project on data centres
- ISO – CENELEC – ETSI Standardisation Initiatives
- Ecolabels
  - The ENERGY STAR specifications for servers, storage units
  - The Blue Angel energy efficient data centre operation
- EU GPP Criteria for Computers and monitors

Preliminary Stakeholder Survey
Metrics to be included in the GPP criteria



Additional suggestions for metrics include:

- Design PUE as for ISO/IEC 30134-2:2016 (Annex C4)
- ISO/IEC 30134-3:2016 Renewable energy factor (REF)
- The Green Grid just published the capacity and utilization metrics
- Water Footprint
- Total CO2 Emissions

Overview of relevant standardized metrics

Metric	ISO	CENELEC	ETSI	Green Grid	SPEC
Power Usage Effectiveness (PUE) Ratio of total energy and IT energy (measure of power and cooling efficiency)	ISO/IEC 30134:2016 Part 2: Power usage effectiveness (PUE)	EN 50600-4-2:2016 Part 4-2: Power Usage Effectiveness	ETSI ES 205 200-2-1 V1.2.1	The Green Grid White Paper 49 – PUE – A Comprehensive Examination of the metric	
Renewable Energy Factor (REF)	ISO/IEC 30134:2016 Part 3: Renewable energy factor (REF)	EN 50600-4-3:2016 Part 4-3: Renewable Energy Factor	ETSI ES 205 200-2-1 V1.2.1		
Energy Reuse Factor (ERF)	ISO/IEC 30134:2016 Part 6: Energy Reuse Factor		ETSI ES 205 200-2-1 V1.2.1		
Water Usage Effectiveness (WUE)				The Green Grid White Paper 35 – WUE – Usage Guidelines	
Carbon Usage Effectiveness (CUE)				The Green Grid White Paper 32 – CUE – Usage Guidelines	
IT equipment efficiency (ITEE)	ISO/IEC 30134:2016 Part 4 (under development): IT Equipment Energy Efficiency for servers (ITEEsv)				SERT v1.x testing tool
IT equipment utilization (ITEU)	ISO/IEC 30134:2016 Part 5 (under development): IT equipment utilization for servers (ITEUsv)			The Green Grid in White Paper 72 – Capacity and utilization metrics	

Improvement strategies: criteria

Criteria to prioritise specific strategies:

- Potential **environmental benefits** based on the LCA review performed
- **Readiness and availability** in the EU market, indicating how available are data centre technologies applying already the specific improvement strategies
- Potential incurred **life cycle costs**, which were based on expert judgment and information provided by other data centre experts
- Degree of **difficulty for verification**, indicating the availability of a potential metric or measure to implement the improvement area, using same scale as for life cycle costs

Improvement Strategies: energy mix

Life cycle hotspots	Improvement strategy	Application level(i.e. focus area)
Energy mix to supply electricity	Hosting/location of server and data storage services in data centre with high renewable electricity share	Whole data centre
	Hosting/location of server and data storage services in data centre with low GHG emissions	Whole data centre

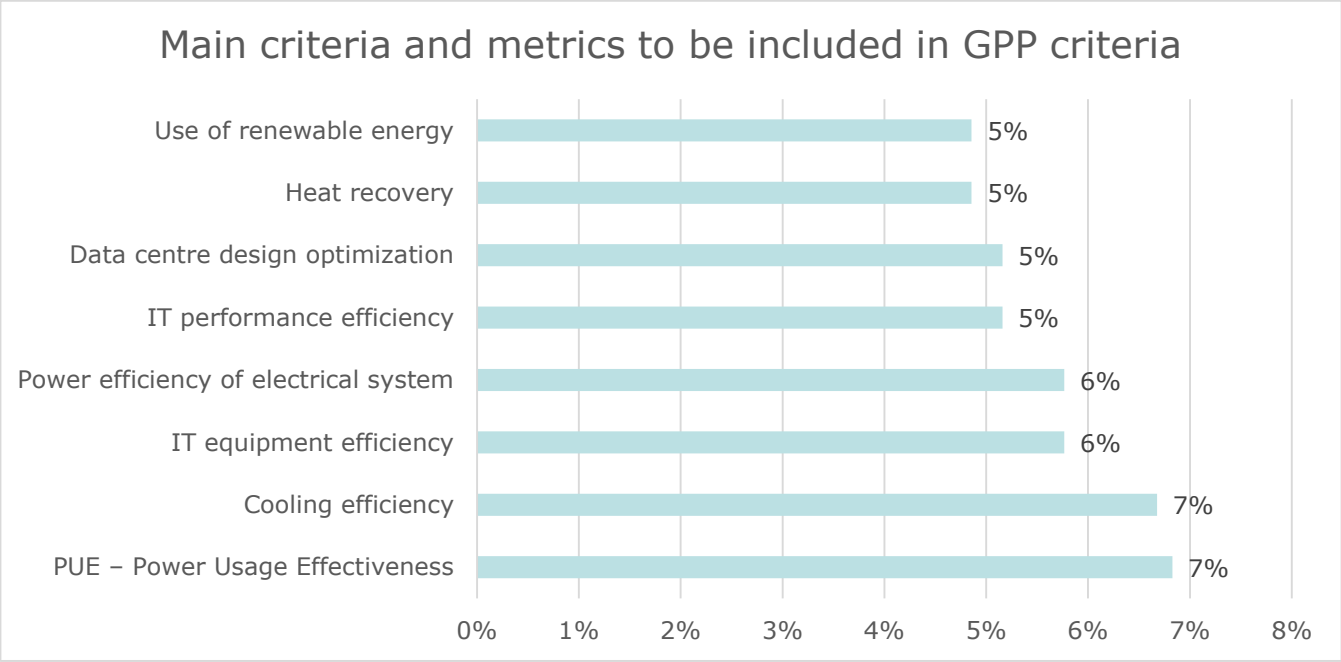
Improvement Strategies: energy consumption

Energy consumption in the use phase	Select high energy efficient server(s)	IT system
	Ensure an high rate of utilisation of IT equipment	IT system
	Select ICT Equipment operating at higher temperature	IT system
	Hosting/location of server and data storage services in data centre with low Power Usage Effectiveness (PUE)	M&E systems
	Reduce energy consumption for cooling systems (operating at higher temperatures)	M&E systems
	Minimize waste heat by reuse in a district heating	M&E systems

Improvement Strategies: manufacturing of IT

Manufacturing of IT	Design for durability – Select ICT with an extended warranty	IT system
	Design for disassembly and reparability – Select ICT with clear disassembly and repair instructions	IT system
	Design for dismantling & recyclability – Select ICT dismantling test reports to facilitate the disassembly	IT system
	End of life management – Collection, resale and tracking	IT system
	Emissions of hazardous substances – halogen free Printed Circuit Boards	IT system

Preliminary Stakeholder Survey
Criteria area to be included in the GPP criteria



Additional suggestions for criteria and metrics:

- water consumption in connection to water scarcity and suggested including a water footprint as a metric.
- Three respondents suggest including CO2-emissions as a metric,
- Some respondents are critical towards the current set of metrics commonly used in the industry

CRITERIA AREAS

Criteria to address these areas of improvement are clustered under three broad areas that relate to design and operation of a data centre:

- **AREA 1 - Data centre performance:** concerns the whole data centre and this criteria area covers aspects related to the whole system design and/or operation which affect its environmental performance

- **AREA 2 - IT system performance:** concerns the IT equipment and this criteria area covers aspects related to the IT system design and/or operation

- **AREA 3 - M&E systems performance:** concerns all the system and equipment aiming to the electrical supply and distribution to support IT loads and thermal operation of a data centre

LCA, LCC, Standards and Technical Improvement Potential
Questions

- Are our finding on Life Cycle Costs representative?
- Are our finding on Life Cycle Environmental Impacts representative?
- Do the improvements areas identified seem appropriate?
- Are the most relevant standards and metrics identified?

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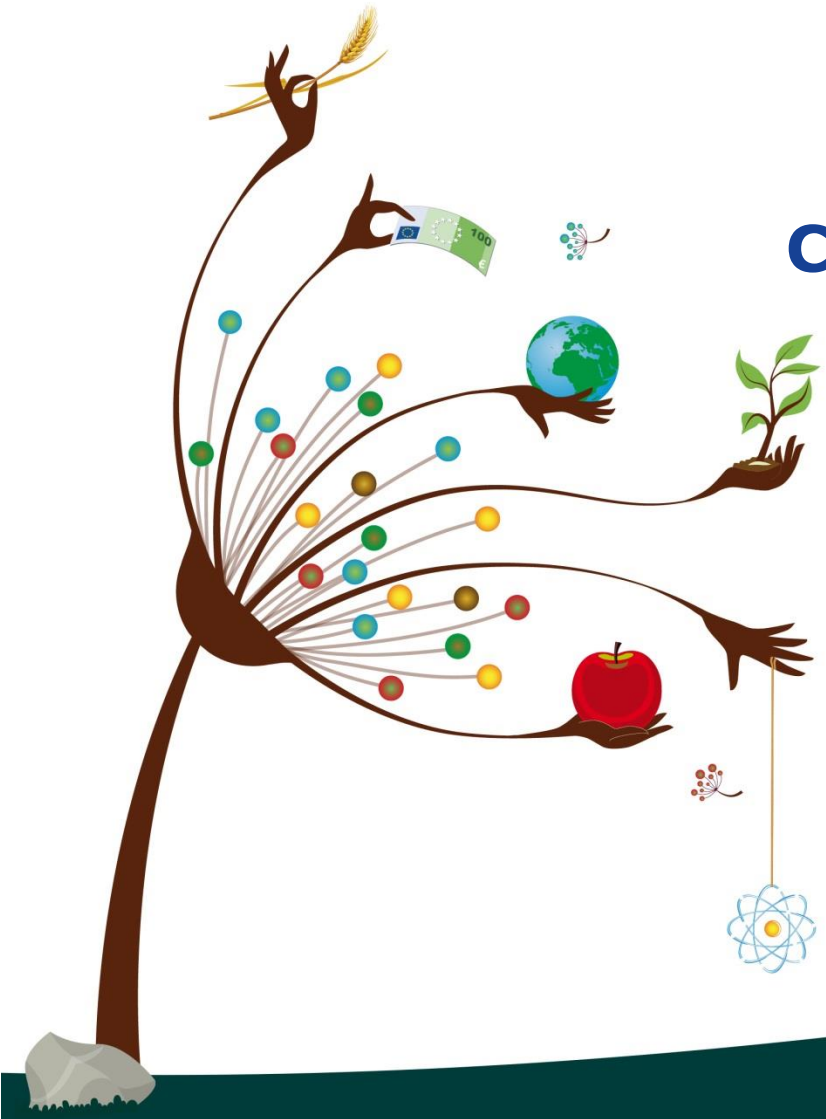

Criteria Area 1: System Level Performance

Seville - 16th November 2017

European Commission

Overview of the criteria area Criteria Area 1 – System Level Performance

Improvement area – Criteria proposal	Criterion code	Description	Application level
Greenhouse gas emissions – Renewable Energy Factor	AC1.1	Points awarded in proportion to the Renewable Energy Factor (REF)	Whole data centre - To be included when the data centre is operated by a third party
	CPC1.1	Monitoring of the Renewable Energy Factor (REF)	Whole data centre - To be included when the data centre is operated by a third party
Greenhouse gas emissions – Facility Greenhouse Gas Inventory	AC1.2	Points awarded in proportion to the estimated GHG emissions	Procurement of a whole new data centre facility
	CPC1.2	Monitoring of the GHG emissions	Procurement of a whole new data centre facility

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.

Greenhouse gas emissions – Renewable Energy Factor

Renewable Energy Factor
Background to the proposal

Emissions from electricity are dependent on:

- the Member State's electricity grid mix
- dedicated generating capacity at data centre sites

Major data centre operators commit to 100% renewable electricity

But how to demonstrate additionality?

- no strict definition - without the client buying the energy, the renewable energy would not otherwise have been generated.
- existing generation may be shifted from one consumer to another

Standardised reference: Renewable Energy Factor (REF) EN 50600-4

Renewable Energy Factor
Life cycle environmental hotspots and potential improvements

At a data centre level, energy consumption in the use phase has the single biggest environmental impact

- Renewable energy identified as the single biggest improvement option
  - ✓ 85% potential reduction when life cycle emissions are taken into account
- Is there a difference in the environmental impacts according to the way it is sourced?

  For example: Transmission & Distribution losses on the grid

Renewable Energy Factor
Life cycle costs implications and trade-offs with environmental potential improvements

Cost implications vary depending on the market, supplier and the individual situation of the data centre

- For green tariffs, Guarantee of Origin (GO) and certified energy, the cost is generally higher
  - ✓ GO trading at approximately 15-30 cents/MWh
- Power Purchase Agreements (PPAs) have high transaction costs
  - ✓ estimated that PPAs <10MW and <10 years are not cost effective

Renewable Energy Factor Verification

At corporate level, check contracts and/or that certificates are issued by authorised authorities at Member State or regional level

- For GOs and PPAs it may be difficult to demonstrate that the supply contract would cover a specific data centre site
- GOs for renewable sources as defined in Directive 2009/28/EC are main source of proof in current EU GPP renewable electricity criteria (2014).
- Other forms of proof?
  - ✓ Renewable energy certificates and Type I ecolabel declarations.

Renewable Energy Factor
Market implications and functionality

In practice, *on or near site* renewables may not be practical if:

- the size of data centre is not large enough to repay the investment
- the high amount of energy consumed cannot be met with the amount of land and resources needed to supply it

Other factors are more significant: electricity/data network and access requirements (generally close to major cities and to a sufficiently capable power grid)

From a functional perspective the electricity supplied is identical and cannot be distinguished.

- Mechanisms to purchase renewable energy bilaterally are available, but not in every EU region.
- For smaller data centres, it may be possible to join consortia to sign PPAs.

Renewable Energy Factor
Applicability to public procurement

Insufficient and variable market availability: technical specification for REF is not proposed.

'Additionality' is restricted because of legal limit of scope to relate prescriptive requirements (e.g. build on site generation) to the subject matter.

Focus instead on the type of plant used to generate the electricity used to provide the data centre service

Mainly applicable to:

- ✓ data centres built or operated as a service to the contracting authority.
- ✓ Co-location sites could be asked to bid based on REF and:
  - existing arrangements for obtaining renewable electricity, or
  - upon location of the contracting authority's IT equipment

Renewable Energy Factor
Proposed criteria

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

Renewable Energy Factor
Proposed criteria

CONTRACT PERFORMANCE CLAUSES	
	CPC1.1 Renewable Energy Factor *To be included when the data centre is operated by a third party.* 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.

Renewable Energy Factor
Questions

- Is this an appropriate improvement area?
- Is Renewable Energy Factor the right metric to use?
- Are the draft criteria proposals as formulated workable?
- For which types of data centre could it work?

Specific points/requests:

- Examples of how additionality has been demonstrated

Greenhouse gas emissions – Facility Greenhouse Gas Inventory

Greenhouse Gas Emissions Background

- This area of criteria is based on the estimation, measurement and reporting of greenhouse gas emissions. Three different approaches are applicable:

INVENTORY LEVEL
Measurement of overall GHG emissions at facility level during a period of time (usually 1 year). It includes:
- Direct (e.g. combustion of fossil fuels at the facility,
- indirect (e.g. electricity production)
- other emissions (e.g stages different from the use phase)

PROJECT LEVEL
Project level for quantification, monitoring and reporting of GHG emission reductions. It includes two steps:
- Validation at design stage
- Verification at monitoring stage

CARBON FOOTPRINT
Measurement of GHG emissions in the lifecycle related to a specific product / service. It requires:
- The definition of a functional unit
- Standardized product category rules

Greenhouse Gas Emissions
LCA and LCC impacts

- Global Warming Potential identified as indicator of relevant impact
- The use phase is the dominant the category global warming potential) and mainly GHG emissions associated to electricity consumption
- Several strategies can contribute to reduce GHG emissions:
  - Renewable electricity
  - Virtualization and high utilization rate
  - Free Cooling
- No major life cycle costs implications identified

Greenhouse Gas Emissions Verification

- **ISO 14064-1:2006** *Greenhouse gases -- Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*

- **ISO 14064-2:2006** *Greenhouse gases -- Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements*

- **ISO 14064-3:2006** *Greenhouse gases -- Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions*

- **GHG Protocol ICT Sector Guidance** – *Cloud Computing and Data Centre Services – Chapter 4 – Guide for assessing GHG emissions of Cloud Computing and Data Center Services*

Greenhouse Gas Emissions
Market Implication and functionality

- Existing initiatives: some initiatives about reporting GHG Inventory or Carbon Footprint by the biggest players (e.g. Facebook, Google)

- It is expected that many data centres would be able to quantify and report their greenhouse gas emissions as long as there is a market incentive, which the GPP can serve to accelerate considering it is already becoming a common practice.

- It has no impacts on data centre functionality.

Greenhouse Gas Emissions
Applicability to public procurement

Enterprise Data Centre and MSP

- Building or expansion of a data center, consolidation and virtualisation projects, operation and maintenance of a facility
- Technical specification would provide the functional basis for making comparisons between offers
- An award criterion could then assign points to the offer with the lowest carbon emissions, thereby encouraging innovation

Outsource to a host or cloud application

- Boundary for the project would be difficult to control e.g. the project may not be dedicated to meeting only the contracting authorities technical specification (allocation of GHG emissions).

Purchase of new equipment

- The product-level standard ISO 14067 would have to be used instead as a data centre project is not being requested.

Greenhouse Gas Emissions
Proposed Criteria

Core criteria	Comprehensive criteria
AWARD CRITERIA	
	AC1.2 Facility greenhouse gas inventory *This criteria is only appropriate for the procurement of a whole new data centre facility.* Points shall be awarded in proportion to the bidder that offers the lowest greenhouse gas emissions per year operation of the project. Bidders shall estimate the greenhouse gas emissions for one year's operation of their data centre design according to the contracting authorities technical specification. 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. **Verification:** 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.
CONTRACT PERFORMANCE CLAUSES	
	CPC1.2 Project greenhouse gas inventory *To be included if criterion AC1.2 is used.* The operator of the data centre project shall monitor and verify the project emissions as estimated at bid stage. 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.

Greenhouse Gas Emissions
Questions

- **Which approach?**
  - Inventory level (total CO2e / year of the facility)
  - GHG Project (reduced CO2e / year compared to the baseline scenario)
  - Carbon Footprint (CO2e / year related to a specific service/product) → selection of functional unit (different data centers perform different tasks)

- **Other approaches investigated:**
  - **Carbon Usage Effectiveness (Green Grid)**
  - Where CUE = CEF*PUE

- **Equivalence between GHG Protocol and ISO**

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Criteria Area 2: IT Level Performance

Seville - 16th November 2017

European Commission

Overview of the criteria area Criteria Area 2 – IT Level Performance

Improvement area – Criteria proposal	Criterion code	Description	Application level
IT energy efficiency – Server energy efficiency	TS2.1	Servers shall meet the ENERGY STAR requirement	Procurement of IT equipment in enterprise and co-location data centres
	AC2.1	Points awarded to servers above ENERGY STAR requirements.	Procurement of IT equipment in enterprise and co-location data centres
IT utilisation – IT equipment utilisation	AC2.2	Points will be awarded based on the anticipated average utilisation rate for the IT equipment	• Consolidation and virtualisation projects • Contracting of managed services
	CPC2.2	Monitoring of the utilization rate	• Consolidation and virtualisation projects • Contracting of managed services

Overview of the criteria area Criteria Area 2 – IT Level Performance

Improvement area – Criteria proposal	Criterion code	Description	Application level
IT Material Efficiency – Emissions of hazardous substances	AC2.3	Points shall be awarded where the main Printed Circuit Board of the server models used are 'halogen free'	Procurement of IT equipment in enterprise and co-location data centres
IT Material Efficiency – Design for durability	TS2.4	Minimum three-year warranty effective from delivery of the servers	Procurement of IT equipment in enterprise and co-location data centres
	AC2.4	Points awarded in proportion to the additional warranty	Procurement of IT equipment in enterprise and co-location data centres
IT Material Efficiency – Design for disassembly and repair	TS2.5	Disassembly and repair instructions to be provided	Procurement of IT equipment in enterprise and co-location data centres

Overview of the criteria area Criteria Area 2 – IT Level Performance

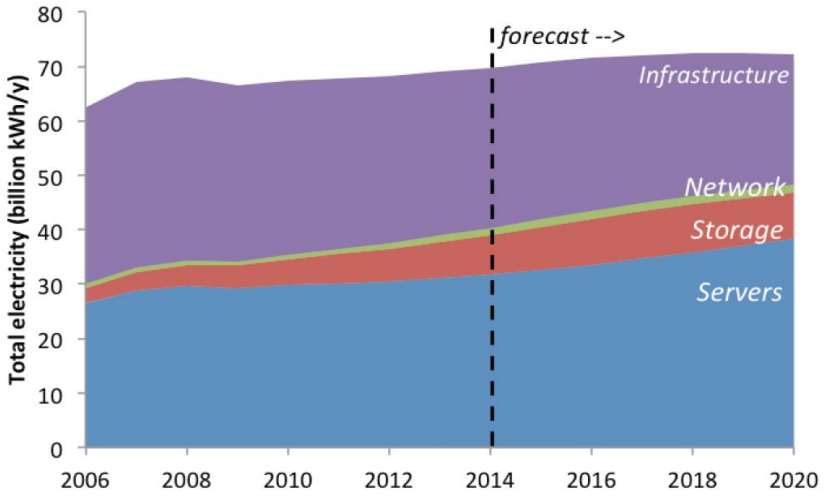
Improvement area – Criteria proposal	Criterion code	Description	Application level
IT Material Efficiency – Design for disassembly and repair	AC2.5	Points awarded based on the availability of spare parts for servers	Procurement of IT equipment in enterprise and co-location data centres
IT Material Efficiency – Design for dismantling and recycling	TS2.6	Dismantling test reports for servers to be provided	Procurement of IT equipment in enterprise and co-location data centres
IT Material Efficiency – End of life management	TS2.7	Re-use and recycling service once the servers have reached the end of its service life.	Contracting of end of life services
	AC2.7	Points awarded to tenderers operating a tracking system for servers	Contracting of end of life services
	CPC2.7	Reporting on the status of the server equipment once processed for re-use or recycling/disposal.	Contracting of end of life services
IT Equipment Operating Range – Temperature and Humidity Range	TS2.8	IT hardware shall be warrantied to operate within a temperature range	Procurement of IT equipment in enterprise and co-location data centres

IT Energy Efficiency – Server Energy Efficiency

IT Energy Efficiency – Server Energy Efficiency - Background

- ENERGY STAR product specifications are in effect for the server
  - **Version 2.0 specification for Enterprise Servers (16 December 2013)**
  - **proposed ENERGY STAR for Enterprise servers version 3.0.**

- ECODESIGN regulation implementing measures for servers and data storage product (DG GROW Lot 9) have been proposed.
  - **Dedicated preparatory study (November 2015)**
  - **Public consultation was open from (July 2017 - October 2017)**
  - **Process expected to be completed by 2019**



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IT Energy Efficiency – Server Energy Efficiency - LCA and LCC impacts

- Servers are the main contributors towards the energy consumption and environmental impacts of a data centre.
- reducing IT consumption consequently also reduces energy consumed in the mechanical and electrical systems.
- higher performance in servers reduces the manufacturing impacts, since fewer servers are needed
- Because efficiency improves very rapidly and servers are operating continuously, it is often cost efficient to replace servers every 3-4 years.
- Frequent replacement of servers could result in an increase in impacts from manufacturing, including greater resource and toxic emission impacts (threshold?)

IT Energy Efficiency – Server Energy Efficiency - Verification

- The energy consumption, and efficiency of a server can vary depending on the configuration and service. → the metric has to be designed to capture the general energy efficiency of a single server rather than represent any specific use-case.

- ENERGY STAR v2 database provides aggregated SERT (Server Efficiency Rating Tool) test results but these are calculated using a method which is weighted towards 100% utilisation and is considered unrepresentative of real life utilisation and efficiency.

- ENERGY STAR v3 (under revision) Based on new SERT method testing tool. Performance is tested at different load levels. Active efficiency and idle efficiency are measured

IT Energy Efficiency – Server Energy Efficiency – Market Implication and functionality

- all EU institutions, central Member State government authorities and public organisations are required to purchase office equipment with energy efficiency requirements that meet the specifications of the ENERGY STAR program. purchased (Annex III of Energy Efficiency Directive).

- Server efficiency in the market changes rapidly, therefore a dynamic criterion that takes account of this is preferable.

IT Energy Efficiency – Server Energy Efficiency – Applicability to public procurements

- A criterion aimed at improving server energy efficiency would be relevant to enterprise and co-location data centres because they require the IT equipment to be specified.
- A technical specification could be appropriate given that both ENERGY STAR and the forthcoming Ecodesign legislation establish performance metrics and thresholds that would differentiate performance in the market.
- An award criterion could additionally be used to encourage higher performance against a minimum threshold.

IT Energy Efficiency – Server Energy Efficiency – Proposed Criteria

Core criteria / Comprehensive criteria
TECHNICAL SPECIFICATIONS
TS2.1 Server energy efficiency Servers shall meet the energy efficiency requirements of the latest version of the ENERGY STAR standard The version in force at the time of publication is 2.0 and updates can be followed at this weblink: http://www.eu-energystar.org/specifications.htm 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. **Verification:** 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. Upon request the contracting authority shall be provided with access to the equipment once on-site at the data centre for auditing purposes. 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.

IT Energy Efficiency – Server Energy Efficiency – Proposed Criteria

AWARD CRITERIA
AC2.1. Improvement in the energy consumption upon the Energy Star active efficiency *It is recommended to use this criterion in conjunction with TS2.1.* ** Please see the Explanatory note for further information.* 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. The energy efficiency value shall be calculated according to the test methods laid down in the latest version of the ENERGY STAR. 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. **Verification:** 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. Upon request the contracting authority shall be provided with access to the equipment once on-site at the data centre for auditing purposes.

- For Energy Star v.3 the award criteria will be based on the active efficiency parameter

IT Energy Efficiency – Server Energy Efficiency – Questions

- Is the focus on servers appropriate?

The technology is improving faster than the regulatory process. There is a risk that energy star products may no longer represent a performance improvement (Energy Star v.2.0) from 2013

- Will the new Energy Star v3.0 reflect the state of the art?
- Is the balance of technical specifications and award criteria workable?

IT equipment – IT equipment utilisation

IT equipment utilisation
Background to the proposal

The amount of work being done as a proportion of the total installed IT capacity.

Historically very low, 10% or below utilisation can be raised in a number of ways:

- Server level: virtualisation and cloud computing allow multiple 'virtual' servers and applications to be run on a physical server
- Storage level: capacity optimisation methods, in particular thin provisioning ensure that physical spare capacity is used

CPU utilisation most frequently referenced and formalised in ISO 30134-5, due Oct 2017

Green Grid propose a more complete measure of utilisation based on CPU, memory, network and storage.

IT equipment utilisation
Life cycle environmental hotspots and potential improvements

Significant improvement potential identified:

15x times reduction in impacts compared to worst case and about 7x times compared to average data centre performance.

Benefits of virtualisation:

'the act of creating a virtual (rather than actual) version of computer hardware platforms, storage devices, and computer network resources'

- ✓ increased IT utilisation
- ✓ Reduce energy consumption (-50%)
- ✓ reduced IT equipment requirements (factor 3-4)
- ✓ avoidance of M&E part loads

IT equipment utilisation
Life cycle costs implications and trade-offs with environmental potential improvements

Increasing utilisation reduces costs because more work is achieved with the same amount of hardware

Energy costs are reduced as there is less hardware and associated mechanical and electrical systems

Case studies (USA)

- ✓ Comparisons made against unvirtualised servers.
- ✓ US EPA: best case scenarios for cost savings of approximately 60%

IT equipment utilisation
Verification

Measurement of IT utilisation is complex

- requires data to be collated almost in real time from every piece of hardware equipment
- Ensuring the data is gathered and reported correctly requires expert knowledge.
- Challenge of a Managed Service Provider providing cloud services across a portfolio of sites and according to a standard protocol

IT equipment utilisation
Market implications and functionality

Market has moved to improve and the number of data centres measuring utilisation is not known

- Green Grid metric proposed in 2017: not known if it reflects widespread practices
- ISO 30143-5 metric accounts only for one aspect of server performance, but could be a starting point.

Clear trend for higher utilisation as data centre size increases, but this may limit the target market

Still some applications, particularly legacy applications, which cannot be virtualised without high risk or difficulty

Security is a concern for public authorities – tendency towards larger operators, dedicated sites.

It equipment utilisation
Applicability to public procurement

Consolidation and virtualisation of existing data centres: enabling assets to be used more efficiently,

Contracting of managed services: how to ensure link between subject matter and verification?

Not yet consensus on a standardised metric at data centre level,

IT equipment (white space) or server (CPU) level?

- ✓ May be suitable as an award criteria to encourage a focus on this performance aspect.
- ✓ Contract Performance Clause needed to monitor performance over time.

IT equipment utilisation
Proposed criteria

Core criteria	Comprehensive criteria
AWARD CRITERIA	
	AC2.2 IT equipment utilisation *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.* Points will be awarded based on the anticipated average utilisation rate for the IT equipment *[or servers]*. Points shall be awarded in proportion to the bidder that offers the highest utilisation. **Verification:** 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]*.

IT equipment utilisation
Proposed criteria

CONTRACT PERFORMANCE CLAUSES	
	CPC2.2 Monitoring of IT Equipment Utilization values *To be included when the data centre is operated by a third party.* The operator of the data centre facility shall provide average monthly data for the total IT *[or servers]* utilization rate of the data centre.
Explanatory note: IT Capacity and Utilisation metric calculation method	
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. ICT Capacity – provisioned at theoretical maxima: $ICT_C = \{CPU_C, MEM_C, STOR_C, NET_C\}$ ICT Utilisation – percentages used of theoretical maxima: $ICT_U = \{CPU_U, MEM_U, STOR_U, NET_U\}$	

IT equipment utilisation
Questions

- Is this an appropriate improvement area?
- Is it practical/feasible to use this type of metric?
- Are the draft criteria proposals as formulated workable?
- For which types of data centre could it work?

Specific points/requests:

- How mature are the EN and Green Grid methods?

IT Equipment Operating Range – Temperature and Humidity Range

IT Equipment Operating Range Background

If a data centre or server room is cooled by energy driving cooling system the energy consumption for cooling can be reduced by allowing a higher temperature.

- The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has established thermal guidelines for data centres

ASHRAE CLASS	Dry bulb temperature (°C)
A1	15-32
A2	10-35
A3	5-40
A4	5-45

Other important parameters related to the operating range are:

- Humidity range
- Dew point
- Maximum rate of change of the temperature (°C/hr)

IT Equipment Operating Range
LCA and LCC impacts

- Increasing the range of the IT equipment operating at temperature and humidity does not directly result in energy savings
- ICT hardware which is warrantied to operate at higher temperatures can allow the operator to increase the set point temperature of the cold air
- It results in a reduction of the energy consumption from mechanical and electrical (M&E) systems
- Moreover more free cooling hours can reduce the need of M&E equipment (i.e. their embodied impacts)

IT Equipment Operating Range Verification

- Equipment should be able to withstand and be within warranty for the full range of temperature defined by the ASHRAE Class A1 or A2.

- Manufacturers specifications and warranties shall be provided for each major IT hardware component.

IT Equipment Operating Range
Market Implication and functionality

- ASHRAE research suggests that increased risk of component failure when operating at higher temperatures is insignificant when the number of hours of exposure is limited (e.g. just at the hottest times of the year).
- High relative humidity was found to have a higher impact on hard disk drive failures
- ICT hardware has a temperature above which its internal fan speeds increase which increases power consumption, which can partially offset potential benefits.

IT Equipment Operating Range
Applicability to public procurement

Enterprise Data Centre

- Purchase of new equipment
- New data centres or expansion
- Consolidation projects

IT Equipment Operating Range
Proposed criteria

TECHNICAL SPECIFICATIONS	
Core criteria	**Comprehensive criteria**
TS2.8 Cooling Management –higher temperature hardware Select ICT hardware which is warrantied to operate within allowable temperature range of 15-32C. **Verification:** Manufacturers specifications and warranties shall be provided for each major IT hardware component..	**TS2.8 Cooling Management –higher temperature hardware** Select ICT hardware which is warrantied to operate within an allowable temperature range of10-35C. **Verification:** Manufacturers specifications and warranties shall be provided for each major IT hardware component..

IT Equipment Operating Range
Proposed criteria

- Are available on the market IT Equipment declaring operating condition class as for ASHRAE? (proposal of ecodesign requirements are under discussion)
- Are ASHRAE Class A1 and A2 the most relevant for the operating range of data centres?
- Would the current proposal work in all locations across the EU?

IT Material Efficiency Criteria

IT Material Efficiency
Background 1/2

- spare parts most frequently replaced are Hard Disk Drives (HDDs) and Solid State Disk (SSD)

- Servers are typically refreshed every 2-5 years depending on the business requirements and 5- 7 years for data storage products.

- A shorter refresh time results in a higher embodied impact, however this is offset (not necessarily 100%) by the improved performance of the newer and more efficient IT hardware

- Servers which are refreshed may be redeployed for less critical applications or sold second hand to other businesses, particularly in less developed markets

- Design for Durability and Reparability can increase the lifetime of the product and the opportunity for a reuse of the servers

IT Material Efficiency
Background 2/2

- Servers high metal and CRM content also means they have a scrap value

- Design for Dismantling and recycling / end of life management services → Increase the recycling rates → less raw extraction and manufacturing

IT Material Efficiency
LCA and LCC impacts

- The contribution to the embodied environmental impacts from manufacturing is mostly originating from servers and storage units

- Significant impacts from the disposal of metal refining waste products during the manufacture of IT components and electricity distribution networks:

  - Sulphidic tailings are a by-product of the mining and refining of gold and copper used to manufacture printed wiring boards

  - Disposal of tailings (especially if not disposed in the correct way)

  - Phthalates and halogen-containing materials—including brominated flame retardants (BFRs), chlorinated flame retardants (CFRs), and polyvinyl chloride (PVC)

IT Material Efficiency – Verification

The initial proposals are largely a reflection of those used in the EU GPP criteria set 'Computers and Monitors'.

- **Design for durability:** warranty shall cover repair or replacement and include a service agreement with options for pick-up and return or on-site repairs.

- **Design for disassembly and repair:**
  - availability of disassembly and repair instructions
  - declaration of the compatible spare parts will be made available

- **Design for dismantling and recycling:** dismantling test reports. The test shall be carried out by a specialised WEEE recycling firm

IT Material Efficiency – Market implication and functionality

- Extending the technical life of a server does not ensure the extension of the functional life. Servers are replaced based on the business requirements.

- Extending the service life of older equipment may also allow second hand market users access to services they would not otherwise have.

- It's not clear the market size for second hand servers or other IT equipment.

IT Material Efficiency - Applicability to public procurement

- Replacing and purchasing new IT Equipment for an enterprise data centre or a co-location data centre

IT Material Efficiency – Proposed Criteria –

Improvement area – Criteria proposal	Criterion code	Description	Application level
IT Material Efficiency – Design for durability	TS2.4	Minimum three-year warranty effective from delivery of the servers	Procurement of IT equipment in enterprise and co-location data centres
	AC2.4	Points awarded in proportion to the additional warranty	Procurement of IT equipment in enterprise and co-location data centres
IT Material Efficiency – Design for disassembly and repair	TS2.5	Disassembly and repair instructions to be provided	Procurement of IT equipment in enterprise and co-location data centres
IT Material Efficiency – Design for disassembly and repair	AC2.5	Points awarded based on the availability of spare parts for servers	Procurement of IT equipment in enterprise and co-location data centres
IT Material Efficiency – Design for dismantling and recycling	TS2.6	Dismantling test reports for servers to be provided	Procurement of IT equipment in enterprise and co-location data centres

IT Material Efficiency – Questions

- Are these appropriate improvement area?

- how effectively the GPP criteria for 'Computers and Monitors translate for data centres?

IT material efficiency – emissions of hazardous substances

Emissions of hazardous substances
Background to the proposal

The dominant impacts related to toxicity relate to:

- ✓ the manufacture of integrated circuits and other electronic components for printing wiring boards
- ✓ the associated processes from manufacturing of raw materials (refining gold and copper, disposal of sulphidic tailings, tin, arsenic and cadmium ions).
- ✓ Informal recycling routes that can arise in third countries.

Design and material selection can prevent and minimise hazardous emissions in the end of life phase.

Emissions of hazardous substances
Life cycle environmental hotspots and potential improvements

Informal recycling and improper treatment of printed circuit boards and cables to recover precious metals and copper are of concern.

- 16-38% of the EU's WEEE waste (550,000 - 1,300,000 tonnes) exported in 2008 (EEA)
- No restrictions on the export of goods for re-use - end of life phase may not comply with expected EU norms.

Analysis of pollution from WEEE treatment sites:

- Polychlorinated and Polybrominated dibenzo-p-dioxins and furans (PCDD/DF and PBDD/DF)
- Carcinogenic Polycyclic Aromatic Hydrocarbons (PAHs)

Evidence of the exposure of communities and the pollution of local environments, (UNEP and the World Health Organisation)

Emissions of hazardous substances
Life cycle costs implications and trade-offs with environmental potential improvements

The end of life stage is of less overall relevance in cost terms.

The cost of 'proper' disposal of Waste Electrical Equipment (WEEE) will have to be met as part of these costs.

This criterion has links with the proposed criterion on end of life management (2.5)

Emissions of hazardous substances
Verification

Proposal reflects those in the EU GPP criteria set 'Computers and Monitors', allowing for easy cross referencing.

- Test results produced according to standardised methods
- Provision of verified results for the relevant equipment models upon award of a contract

Discussion with stakeholders to understand how effectively these can also be used for data centres.

Emissions of hazardous substances
Applicability to public procurement

When replacing and purchasing new IT Equipment for an enterprise data centre or a co-location data centre.

- ✓ Low emission PCB requires a change in the board material and flame retardant used.
- ✓ Leading IT equipment manufacturers have been moving to alternative materials and chemistry.
- ✓ Picture needs confirming for servers, including those operating at higher temperatures.

To encourage innovation it is proposed only as award criteria.

Emissions of hazardous substances
Proposed criteria

AWARD CRITERIA [61]	
	AC2.3 Emissions of hazardous substances – printed circuit boards 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. **Verification:** 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. 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).

Emissions of hazardous substances
Questions

- Is this an appropriate improvement area?
- Are the draft criteria proposals as formulated workable?
- For which types of data centre could it work?

Specific points/requests:

- Application to high temperature operation

IT material efficiency – end of life management services

End of life management services
Life cycle costs implications and trade-offs with environmental potential improvements

The end of life stage is of less overall relevance in cost terms.

The decommissioning cost of collecting and preparing Waste Electrical Equipment (WEEE) for reuse will have to be met as part of these costs.

End of life management services
Market implications and functionality

Potential security and data protection risks associated with reuse of hardware.

- Methodologies for data erasure are available, e.g. NIST guidelines SP800-88.
- Extending the service life of older equipment may allow second hand market users access to services they would not otherwise have.
- When the equipment eventually reaches the end of its useful life it is difficult to ensure that it is disposed of responsibly.

End of life management services
Applicability to public procurement (1)

Replacement and purchasing of new IT Equipment for an enterprise data centre or a co-location data centre the public authority

- May be best achieved through the distribution of serviced and upgraded IT equipment by specialist third parties.
- Secure data sanitisation and erasure of drives is an important first step in facilitating the re-use of servers. *But* subject to very specific requirements set by the customer.
- Separate contracting may be required independent of the contract to supply new equipment,
- Requirement to extend the life of the equipment and to guarantee proper treatment upon the end of life.

End of life management services
Applicability to public procurement (2)

Standardised reference points

- ✓ Article 8 and Annexes VII and VIII of the WEEE Directive.
- ✓ ETSI EN 305 174-8 (Electronics Disposal Efficiency): percentage of equipment disposed of through formally recognised responsible entities.
- ✓ At a comprehensive award level, the use of tracking systems and the dismantling of equipment according to EN 50625-1.

End of life management services
Proposed criteria

Core criteria	Comprehensive criteria
TS2.7 End of life management 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: - 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. 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. **Verification:** 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.	**TS2.7 End of life management** 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: - 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. 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. **Verification:** 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.

End of life management services
Proposed criteria

AWARD CRITERIA [61]	
	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.

End of life management services
Questions

- Is this an appropriate improvement area?
- To what extent is this already put into practice?
- Are the draft criteria proposals as formulated workable?
- For which types of contractual arrangements could it work?

Specific points/requests:

- Is the ETSI EN 305 standard used/appropriate?

The European Commission's science and knowledge service

Joint Research Centre

Criteria Area 3: M&E Level Performance

Seville - 16th November 2017

European Commission

Overview of the criteria area - Criteria Area 3 – M&E Level Performance

Improvement area – Criteria proposal	Criterion code	Description	Application level
Mechanical & Electrical systems energy efficiency – Power Utilisation Effectiveness (PUE)	TS3.1	PUE target to be met.	• Construction of a new data centre • Expansion or consolidation of an existing site
	AC3.1	Points awarded to tenderers based on the PUE	• Construction of a new data centre • Expansion or consolidation of an existing site. • Managed services in a specific hosting facility
	CPC3.1	Monitoring of the PUE	Managed services in a specific hosting facility
Cooling – Reuse of waste heat	TS3.2	The data centre shall be connected to and supply waste heat to the local district heating network (expressed as the Energy Reuse Factor)	• Construction of a new data centre • Expansion or consolidation of an existing site.
	AC3.2a	Points shall be awarded to bidders that commit to supply waste	• Construction of a new data centre • Expansion or consolidation of an existing site.

Overview of the criteria area - Criteria Area 3 – M&E Level Performance

Improvement area – Criteria proposal	Criterion code	Description	Application level
Cooling – Reuse of waste heat	AC3.2b	Points shall be awarded in proportion to the bidder that offers the highest Energy Reuse Factor.	Contracting of managed services
	CPC3.2	Monitoring of the heating supply	To be included when the data centre is operated by a third party.
Cooling management – Operating conditions control	AC3.3	Points awarded based on the % of operating hours ensured within a specific temperature range.	To be included when the data centre is operated by a third party.
	CPC3.3	Monitoring and report environmental conditions	Contracting of managed services
Cooling – Water discharge	AC3.4	The data centre designer (or operator) shall be awarded points based on the volume of water discharged on site.	Construction of a new data centre Expansion or consolidation of an existing site. Contracting of managed services
	CPC3.4	The water discharged shall be measured and reported on.	Contracting of managed services

M&E Systems Energy Efficiency – Power Utilisation Effectiveness (PUE)

Power Utilisation Effectiveness (PUE)
Background

- Power utilisation effectiveness (PUE) is the ratio of total amount of energy used by a data centre facility to the energy delivered to the IT equipment.

- PUE was published in 2016 as a global standard under ISO/IEC 30134-2:2016, and there is also a European standard under EN 50600-4-2:2016.

Main discussions about PUE about limit and misuses:

- PUE values tend to improve with high IT loads, regardless of if any M&E improvements have been made.

- IT load can drop when more efficient IT equipment is installed, causing a degradation in PUE values.

- the influence of climate should be considered when establishing minimum thresholds

PUE - LCA and LCC impacts

LCA impacts:

- Energy consumption savings related to the M&E System
- Make sure that PUE does not mask low IT efficiency, utilisation or a shift in loads between M&E and IT. PUE value can improve, but total energy consumption might be unchanged or could even increase.

LCC costs. Generally a lower PUE means lower operative costs (- OPEX). Based on the strategy to reduce M&E, it could have implications for capital expenditure (CAPEX)

- Thermal design improvement
- More efficient M&E equipment (+ CAPEX) or avoidance of equipment
- IT be able to operate at higher temperature (+ CAPEX)

PUE – Verification

The standardised method for calculating PUE is provided in:

- ISO/IEC 30134:2016 Part 2
- and EN 50600-4-2:2016.

A similar approach is provided by the Blue Angel Criteria Energy Efficient Data Center Operation | RAL-UZ 161 where Energy Usage Effectiveness (EUE) is the ratio of the annual energy demand of the entire data centre to the energy demand of the IT equipment over a period of one year.

PUE – Market implication and functionality

The Ecodesign Impact Assessment for servers and storage has mapped the average PUE of different data centres and server rooms. In the Business As Usual (BAU) scenario where eco-design does not come into force to push the PUE lower,

- by 2019 SME server spaces can be expected to have a PUE of 2.5,
- older legacy data centres can have a PUE of 1.9 – 2,
- newer enterprise data centres can achieve 1.65
- and cloud or hyperscale data centres can achieve 1.35.

PUE– Applicability to public procurements

The use of PUE could be mainly applicable to the following procurement routes:

- new data centre is to be built or where
- expansion or consolidation of an existing site

In the case of co-location, possible host sites could be asked to bid based on the efficiency of the M&E infrastructure, which would need to be verified based on monitored data.

It could be a:

- a technical specification in the case of a predicted design performance. (Blue Angel sets a benchmark of 1.4 for good performance)
- an award criteria could leave performance open to the market, or relate the points awarded to a benchmark.
- a contract performance clause to ensure that PUE is maintained within a range or below a specific threshold.

PUE – Proposed Criteria

Core criteria

TECHNICAL SPECIFICATIONS

TS3.1 Target Power Usage Effectiveness (PUE)

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).

Verification:

Design calculations which show how the target is met according to ISO/IEC 30134:2016 Part 2, EN 50600-4-2:2016 or equivalent.

AWARD CRITERIA

AC3.1 Power Usage Effectiveness (PUE)

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:

1. Relative to the benchmark PUE value above (TS1.1 core)
2. Relative to the best performing PUE offer (full points)

For newly designed facilities (not yet operational), points could be awarded relative to the best predicted design PUE at 25% IT load.
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.
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.

Verification:

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.

PUE – Proposed Criteria

Comprehensive criteria

TECHNICAL SPECIFICATIONS

TS3.1 Target Power Usage Effectiveness (PUE)

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).

Verification:
Design calculations which show how the target is met according to ISO/IEC 30134:2016 Part 2, EN 50600-4-2:2016 or equivalent.

AWARD CRITERIA

AC3.1 Power Usage Effectiveness (PUE)

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:

1. Relative to the benchmark PUE value above (TS1.1 comprehensive)
2. Relative to the best performing PUE offer (full points)

For newly designed facilities (not yet operational), points could be awarded relative to the best predicted design PUE at 25% IT load.
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.
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.

Verification:

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.

PUE – Proposed Criteria

CONTRACT PERFORMANCE CLAUSES	
CPC3.1 Monitoring of Power Usage Effectiveness (PUE) input values *To be included when the data centre is operated by a third party*. The operator of the data centre facility shall provide monthly data for the total metered electricity consumption of the data centre and the sub-metered electricity consumption for the IT equipment that is located in the data centre.	**CPC3.1 Monitoring of Power Usage Effectiveness (PUE) input values** *To be included when the data centre is operated by a third party*. The operator of the data centre facility shall provide monthly data for the total metered electricity consumption of the data centre and the sub-metered electricity consumption for the IT equipment that is located in the data centre.

PUE – Proposed Criteria - Questions

- Performance metrics complementing PUE seems to be needed:
  - Monitoring of IT load?
  - Total energy consumption?
- Need for different targets based on data centres type?
- Need for different targets based on geographical areas?
- PUE linked to a specific site(s), what about Cloud Services?

Mechanical & Electrical systems performance – reuse of waste heat

Reuse of waste heat
Background to the proposals (1)

Significant potential exists for waste heat reuse since over 98% of the energy consumed is eventually dissipated

Effectively reusing waste heat depends on:

- ✓ Colocation of the data centre to heat loads
- ✓ Heat grade i.e. suitable temperature for the customer needs
- ✓ Infrastructure for transporting heat

Generally low grade (35-45oC or <25 oC) and expensive to transport.

Upgrading needed using air to air or air to water heat pumps to raise it to a suitable temperature (70 oC).

Smaller networks can be supplied with lower grade heat, particularly for space heating within buildings e.g. Vienna.

Reuse of waste heat
Background to the proposals (2)

Heat reused can be measured using the KPI_{REUSE} (Energy Reuse Factor) as defined in ETSI ES 205 200-2-1.

Energy Reuse Factor (ERF) calculation considers re-use as a secondary objective:

- "non-use" is better than "re-use" and therefore the KPI REUSE will reflect a preference for energy consumption reduction rather than re-use;
- KPI_{REUSE} reflects a preference for re-use of energy heat generated by the ITE/NTE.

ERF is therefore designed to reflect the system efficiency of the data centre and proportionally how much heat is dissipated.

Reuse of waste heat
Life cycle environmental hotspots and potential improvements

It has not been possible to identify LCA studies quantifying the environmental benefits when waste heat is reused.

In countries and cities where there is heating network infrastructure (e.g. Denmark and Sweden, cities such as Paris and Berlin), carbon savings have been identified

- ✓ For each 1MWh of heat reused, the annual carbon reduction could be approximately 260 kg CO_2 eq
- ✓ Reduction in other associated emissions such as CO, NOx and particulates

Reuse of waste heat
Life cycle costs implications and trade-offs with environmental potential improvements

Costs and benefits are highly site specific

- Case studies estimate payback periods of around 3 years.
- assumed that the capital cost of a new district heating network to facilitate heat reuse would be borne by a utility company or local authority (which could also be the contracting authority).
  - ✓ Stockholm city district heating network has actively encouraged connection of data centres, with simplified connection and contractual arrangements.

Reuse of waste heat
Verification

Heat reuse is generally easy to verify through contracts and should be monitored along the contract duration.

- Heat reused can be verified by metering the heat at the point of supply entry to district heating or another network or building(s).
- Energy Reuse Factor (ERF) can be calculated based on ETSI ES 205 200-2.
  - ✓ Energy re-used must be measurable in kWh at the intended point of supply to the network i.e. any losses on the network shall not be included.

Reuse of waste heat
Market implications and functionality

Large potential for heat reuse in data centres based on the distribution of the district heating in some areas of Europe

But locations may not meet the other infrastructure requirements for data centres

- ✓ physical space
- ✓ network connectivity
- ✓ energy supply

Functionality is not considered to be affected.

Reuse of waste heat
Applicability to public procurement

Use to be adapted to local circumstances i.e. if there is already a mature network then a comprehensive criterion

- If no existing network but potential large heat demands than an award criterion could encourage co-location and heat re-use.
  - ✓ In the case that heat cannot be supplied to the network a feasibility report would have to be provided showing why it was not feasible.
- Considered easier to integrate heat recovery equipment into the design of a new data centre
  - ✓ Enterprise data centre procurement scenario would be the most appropriate for this criterion.
- An award criterion could also be used to encourage innovation amongst service providers, albeit potentially across many facilities.

Reuse of waste heat
Proposed criteria

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATIONS	
	TS3.2 Waste heat reuse *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.* 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. **Verification:** The Energy Reuse Factor (ERF) shall be calculated for each facility according to ETSI ES 205 200-2-1. 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. 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.

Reuse of waste heat
Proposed criteria

AWARD CRITERIA	
	AC3.2a Waste heat reuse (for new data centres) *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.* 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. **Verification:** The Energy Reuse Factor (ERF) shall be calculated for each facility according to ETSI ES 205 200-2-1. 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. Upon request the contracting authority shall be provided with access to the equipment and network

Reuse of waste heat
Proposed criteria

CONTRACT PERFORMANCE CLAUSES	
	CPC3.2 Monitoring of the heating supply and connection *To be included when the data centre is operated by a third party.* The operator of the data centre facility shall provide average monthly data for the heat supplied to the local district heating network. In addition the Energy Reuse Factor (ERF) shall be calculated according to ETSI ES 205 200-2-1 and reported on.

Reuse of waste heat
Questions

- Is this an appropriate improvement area?
- Are the draft criteria proposals as formulated workable?
- Is it possible to set a reuse threshold in the case of there being a network?
- For which types of contractual arrangements could it work?

Specific points/requests:

- Is the ETSI ERF metric appropriate?

Cooling management – Operating Conditions control

Cooling management – Operating Conditions control - Background

- Environmental impact of data centre cooling systems can be reduced operating at higher internal temperatures → free or economized cooling.

- Provided the air delivered to the IT equipment is managed and kept within recommended and allowable environmental ranges, this does not adversely affect hardware failure rates

Cooling management – Operating Conditions control - LCA and LCC impacts

LCA Impacts

- Operating at higher temperatures reduce the energy needs for cooling and facilitates dematerialisation.
- Risk of side effects: IT equipment has a temperature above which its internal fan speeds increase which increases power consumption, which can partially offset potential benefits.
- Risk of IT equipment failure

LCC impacts

- The reduction of cooling demand has positive impact on the life cycle costs of a data centre under OPEX Facilities.
- Reduced the need of M&E equipment (i.e. their embodied impacts)

Cooling management – Operating Conditions control - Verification

- Room level metering of supply air temperature and humidity

Install metering equipment at room level capable of indicating the supply air temperature and humidity for the IT equipment.

Cooling management – Operating Conditions control – Market Implication and functionality

Potential risks of component failure need to be managed:

- Air management best practices shall be applied and air hot spots shall be removed before to plan to raise set points
- ASHRAE research suggests that increased risk of component failure when operating at higher temperatures is insignificant when the number of hours of exposure is limited (e.g. just at hottest times of year).
- High relative humidity was found to have a higher impact on hard disk drive failures than high temperatures.

Cooling management – Operating Conditions control – Applicability to public procurements

The operation at higher temperatures criteria is relevant when:

- designing a new or upgrading / expanding an existing facility.
- it could also be used when choosing a colocation facility.
- Using a Service Level Agreement (SLA) for operating at higher temperatures could form part of an outsourcing contract with contract performance clauses used to ensure this best practice is maintained.

Cooling management – Operating Conditions control – Proposed criteria

AWARD CRITERIA
AC3.3 Cooling Management – operating at higher temperatures 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. In the case of data centre operators, this proposed performance shall form part of a service level agreement (SLA) **Verification:** The tenderer shall state the operating conditions that they will provide supported by the calculations on which they are based.
CONTRACT PERFORMANCE CLAUSES
CPC3.3 Reporting on environmental conditions Under the service level agreement the successful tenderer shall monitor the hourly temperature at or near the air inlet of the white space and provide an annual report to the contracting authority with the % hours within range.

Cooling management – Operating Conditions control - Questions

- Reliability issue / perception: Could it affect the applicability of this criteria?

- 18°C - 27°C is the correct range?

- Are there other ways to encourage air management best practice?

Additional information/methods

— The type of cooling systems used to maintain within operating range
— Relevance of other methods e.g. achieved economised cooling hours (EU Code of Conduct)

Cooling management – Water discharge

Cooling –Water discharge - Background

Direct water consumption in a data centre

- Water consumed for cooling the data center equipment (including cooling tower evaporation, blowdown, and drift)
- Humidification
- Water used in the production of energy (on site)

Indirect water consumption:

- water used off-site in the production of the energy used on-site
- water used off-site for the treatment of polluted discharged water

Cooling –Water discharge - LCA and LCC impacts

- The impact categories associated with water are resource depletion and toxicity
- Water stress is increasing across some parts of Europe. Resource depletion can be a relevant impact in severely water stressed regions (e.g. regions with Water Exploitation Index (WEI) >40%) In other regions, resource depletion can be a less relevant issue.
- In the case of the water consumption in cooling towers, the majority of the impact comes from the water discharge and the following treatment of the bleed-off water.
- Relevant quantities of clean water consumed for water treatment.

Cooling –Water discharge Verification

- Metering is required and may already be in place
- Existing metrics may be used along with processes employed as part of environmental management systems

New metrics:

- Water Usage Effectivenss (WUE) = Annual Water Usage / IT Equipment Energy. The units of WUE are liters/kilowatt-hour (L/kWh).

Cooling –Water discharge – Market Implication and functionality

- Measurement is an important first step towards managing the volume of water discharged.

- One way in which water discharged could be reduced is by increasing the number of cycles in evaporative cooling systems before, where conditions allow, discharging to drain.

- This could be based on measured water quality rather than a prescribed number of cycles. It is difficult to be prescriptive on solutions to reduce water discharge as each local environment is different and water quality must be managed as an operational risk.

Cooling –Water discharge - Applicability to public procurements

- Water discharge volumes and measurement of them should be considered when designing a new or expanding / upgrading an existing facility.

- When facilities services are outsourced, the measurement and reporting of water discharged can be specified to track performance.

Cooling –Water discharge – Proposed criteria

Core criteria	Comprehensive criteria
AWARD CRITERIA	
AC3.4 Minimise water discharged on site The data centre designer (or operator) shall be awarded points based on the volume of water discharged on site. Points shall be awarded to bidders that commit to discharge less than 2 litres per kWh of IT equipment electricity consumed (annually). **Verification:** The designer (or operator) shall report the projected and / or measured water discharged per kWh IT electricity consumed (annually).	**AC3.4 Minimise water discharged on site** The data centre designer (or operator) shall be awarded points based on the volume of water discharged on site. Points shall be awarded to bidders that commit to discharge less than 1 litre per kWh of IT equipment electricity consumed (annually). **Verification:** The designer (or operator) shall report the projected and / or measured water discharged per kWh IT electricity consumed (annually).
CONTRACT PERFORMANCE CLAUSES	
CPC3.4 Measurement and reporting of water discharged on site The water discharged shall be measured and reported on. Data shall be obtained from the water supplier, or in the case of co-location facilities sub metering shall be used.	**CPC3.4 Measurement and reporting of water discharged on site** The water discharged shall be measured and reported on. Data shall be obtained from the water supplier, or in the case of co-location facilities sub metering shall be used.

Water Discharge
Questions

- **Consumption vs. Discharge ?**

- **Shifting of the water use from one site to another ?** (e.g. the use of a direct expansion cooler which needs no water, instead of a cooling tower–based chiller, which uses the evaporation of water as a heat rejection mechanism).

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 Friday 8th December 2017**

Thank you for your attention

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European Commission

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