JRC SCIENCE FOR POLICY REPORT

Revision of the EU Green Public Procurement (GPP) Criteria for Computers and Monitors (and extension to Smartphones)

Abstract

EU Green Public Procurement (GPP) Criteria revision for Computers and Monitors Technical report v2.0: revised draft criteria

The revision of these Green Public Procurement (GPP) criteria is aimed at helping public authorities to ensure that ICT equipment and services are procured in such a way that they deliver environmental improvements that contribute to European policy objectives for energy, climate change and resource efficiency, as well as reducing life cycle costs.

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LIST OF ACRONYMS

AC	Award criteria	LCD	Liquid Crystal Display
B2B	Bussines to Bussines	ODD	Optical Disc Drive
BBP	Benzyl butyl phthalate	OEM	Original Equipment Manufacturer
CPC	Contract performance clauses	PBB	Polybrominated biphenyls
CPU	Central Processing Unit	PBDE	Polybrominated diphenyl ethers
CRM	Critical Raw Materials	PC	Personal Computer
DaaS	Device as a Service	PCB	Printed Circuit Board
DBP	Dibutyl phthalate	PCF	Product Carbon Footprint
DEHP	Bis(2-ethylhexyl) phthalate	PCC	Post-consumer Recycled Content
DIBP	Diisobutyl phthalate	PMMA	Poly(methyl methacrylate)
EMI	Electromagnetic Interference	PSU	Power Supply Unit
EoL	End of Life	RAM	Random-access Memory
EPS	External Power Supply	RoHS	Restriction of Hazardous Substances Directive
ESD	Electrostatic-sensitive Device	SC	Selection criteria
GHG	Greenhouse Gas	SoC	State of Charge
GPP	Green Public Procurement	SoH	State of Health
GWP	Global Warming Potential	SME	Small Medium Enterprise
HDD	Hard Disk Drive	SSD	Solid-state Drive
HDMI	High-Definition Multimedia Interface	SVHC	Substance of Very High Concern
IC	Integrated Circuit	TS	Technical specifications
ICT	Information and Communications Technology	UPA	universal power adapter
LCA	Life Cycle Assessment	USB	Universal Serial Bus
LCC	Life Cycle Cost	VGA	Video Graphics Array

1   INTRODUCTION

This document is intended to provide the background information for the revision of the EU Green Public Procurement (GPP) criteria for Computers and Displays. The new proposed title is **EU Green Public Procurement (GPP) Criteria for Computers, Monitors, Tablets and Smartphones**.

The study has been carried out by the Joint Research (JRC) with technical support from the consulting firm Oeko-Institut. The work is being developed for the European Commission Directorate-General for Environment. EU GPP criteria aim at facilitating public authorities the purchase of products, services and works with reduced environmental impacts.

The use of the criteria is voluntary. The criteria are formulated in such a way that they can be, if deemed appropriate by the individual authority, integrated into its tender documents.

There are four main types of GPP Criteria:

> **a. Selection criteria (SC)** assess the suitability of an economic operator to carry out a contract and may relate to:
>
>> - (a) suitability to pursue the professional activity;
>>
>> - (b) economic and financial standing;
>>
>> - (c) technical and professional ability.
>
> **b. 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;
>
> **c. Award criteria (AC),** qualitative criteria with a weighted scoring which are chosen to determine the most economically advantageous tender. The criteria are linked to the subject-matter of the public contract in question and may comprise, for instance:
>
>> - Environmental performance characteristics, including technical merit,
>>
>> functional and other innovative characteristics;
>>
>> - organisation, qualification and experience of staff assigned to performing the contract, where the quality of the staff assigned can have a significant impact on the level of performance of the contract; or

- after-sales service and technical assistance, delivery conditions such as delivery date, delivery process and delivery period or period of completion.

Award criteria shall be considered to be linked to the subject-matter of the public contract where they relate to the works, supplies or services to be provided under that contract in any respect and at any stage of their life cycle, including factors involved in:

- (a) the specific process of production, provision or trading of those works, supplies or services; or

- (b) a specific process for another stage of their life cycle, even where such factors do not form part of their material substance.

d. 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, provided that they are linked to the subject-matter of the contract.

For each set of criteria there is a choice between 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.

1.1 The criteria revision process and evidence base

The main purpose of this document is to present the second draft of the developed criteria, taking into account the background technical analysis presented in the preliminary report produced by Oeko-Institut and addressing key aspects of this product group:

- Market development since the last update;

- Application of current GPP criteria;

- Technical aspects (including existing GPP criteria, legal provisions and voluntary approaches).

A general questionnaire about scope was sent out to a wide range of stakeholders in May 2019. The target groups were government, industry, service providers, NGOs, academics and

public procurers. The input provided has been incorporated in the present report, and together with the outcome of the preliminary report, is the basis for the proposed revised criteria and for continuing the consultation with the stakeholders. Once this is finalised, a final version of this report and a final set of criteria will be established.

This draft revised report is the outcome after the 1st AHWG meeting which took place on 11th of December 2019 in Seville (Spain) and the following commenting period that took place until the 3rd of February 2020.

1.2   Scope definition

The current EU GPP criteria for computers and monitors (2016)[1] has the following products under its scope:

Stationary computers

- Desktop Computers (including Integrated Desktop Computers and Thin Clients)
- Small-scale servers
- Workstations

Display devices
- Computer monitors

Portable computers
- Notebook Computers (including subnotebooks)
- Two-In-One Notebook
- Tablet Computers
- Portable All-In-One Computer
- Mobile Thin Client

1.2.1   Stakeholder feedback

In the initial phase of the revision process stakeholders were asked through a questionnaire (May 2019) to provide feedback on whether the current scope reflects computer and monitor equipment procurement priorities. Many of the respondents agreed that the scope covers the needs, although some comments asking for clarifications and/or possibility to adapt the scope were received:

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[1] https://ec.europa.eu/environment/gpp/pdf/EU_GPP_criteria_for_computers_and_monitors.pdf

- Small-scale servers should be addressed in the server related GPP (i.e. devices installed in a data centre or server room).

- The terminology for portable computers should be revised

- Most All-In-One Computers are stationary and not part of the portable segment.

- Smartphones could be a part of the GPP criteria for computers

- Display devices should include projectors and large format displays

In terms of scope revision, the analysis described in Preliminary Report highlights a substantial overlap of the environmental criteria for mobile equipment applied by voluntary approaches (ecolabels) for smartphones, tablets and notebooks. Moreover, different mobile ICT products could be part of the same tender. Some stakeholders also suggested that a more harmonised approach could facilitate the work to the procurers in the implementation of GPP Criteria. Moreover, the analysis of environmental impacts (see section 1.4) shows very similar hotspots related to the lifecycle of these products. Large scale displays are included according to the definition of display form the Ecodesign regulation for displays. According this regulation, there is no maximum size of the display defined. Additional clarifications on the scope were suggested during the first written consultation, including the differentiation between mobile and stationary workstations.

1.2.2   Revised scope proposal

Taking into account the previous comments the following scope was proposed and agreed by stakeholders at the first AHWG meeting:

Table 1:   Proposed revised scope of the GPP criteria for ICT devices

Proposed revised scope of the GPP criteria (second proposal)

Stationary ICT devices
  • Computers
    • Desktop computers
    • All-in-one computers (or integrated desktop computers)
    • Desktop Thin clients
    • Desktop Workstations
  • Computer displays
 	
Mobile ICT devices
  • Portable computers
    • Notebooks
    • Two-in-one notebooks
    • Mobile Thin Clients
    • Mobile workstations
  • Tablets
  • Smartphones

The following definitions are applied according to the Commission Regulation N° 617/2013 of 26 June 2013 regard to ecodesign requirements for computers and computer servers:

- **'Desktop computer'** means a computer where the main unit is intended to be located in a permanent location and is not designed for portability and which is designed for use with an external display and external peripherals such as a keyboard and mouse.

- **'All-in-one computer' (or integrated desktop computer)** means a computer in which the computer and the display function as a single unit, which receives its AC power through a single cable. Integrated desktop computers come in one of two possible forms: (1) a product where the display and the computer are physically combined into a single unit; or (2) a product where the display is separated from the computer but it is connected to the main chassis by a direct current (DC) power cord. An integrated desktop computer is intended to be located in a permanent location and is not designed for portability. Integrated desktop computers are not primarily designed for the display and reception of audiovisual signals.

- **'Desktop Thin client'** means a computer that relies on a connection to remote computing resources (e.g. servers) to obtain primary functionality and has no rotational storage media integral to the product. The main unit of a desktop thin client must be intended for use in a permanent location (e.g. on a desk) and not for portability. Desktop

thin clients can output information to either an external or, where included with the product, an internal display;

- **'Workstation'** means a high-performance, single-user computer primarily used for graphics, Computer Aided Design, software development, financial and scientific applications among other compute intensive tasks;

- **'Notebook computer'** means a computer designed specifically for portability and to be operated for extended periods of time either with or without a direct connection to an AC power source. Notebook computers utilise an integrated display, with a viewable diagonal screen size of at least 22,86 cm (9 inches), and are capable of operation on an integrated battery or other portable power source.

- **'Mobile thin client'** means a type of notebook computer that relies on a connection to remote computing resources (e.g. computer server, remote workstation) to obtain primary functionality and has no rotational storage media integral to the product.

Compared to the Ecodesign the scope of EU GPP reflects a broader range of computer products on the market. Definitions applied are based on ecolabels (e.g. EU Ecolabel, TCO Certified Generation 8, EPEAT):

- **'Tablet Computer'** (often referred to as 'slate computer') means a wireless, portable computer that is primarily for battery mode usage and has a touch screen interface. This means that connection to mains via an adapter is considered to be mainly for battery charging purposes and the onscreen virtual keyboard or a digital pen is in place of a physical keyboard. Devices with a visible display area of less than 100 cm^2 are not considered to be Tablet Computers under this specification.

- **'Two-in-one notebook':** A computer which resembles a traditional notebook computer but has a detachable display which can act as an independent Slate/Tablet when disconnected.

- **'Smartphone'** is an electronic device used for long-range communication over a cellular network of specialized base stations known as cell sites. It must also have functionality similar to a wireless, portable computer that is primarily for battery mode usage and has a touch screen interface. Connection to mains via an external power supply is considered to be mainly for battery charging purposes and an onscreen virtual

keyboard or a digital pen is in place of a physical keyboard. Screen size is generally between 3 and 6 inches.

These product definitions are inclusive of any external peripherals (e.g. mouse, track pad, keyboard) and power supplies that can be supplied with the product.

The GPP criteria presented in this report are applicable to different procurement routes as described in Chapter 1.5. The scope of this proposal covers also the procurement of refurbished / remanufactured computers (see 2.5). A guidance for the applicability of the criteria to different product groups and prioritisation is presented in the chapter 3.13 of this report.

1.2.3 Policy context: the A new Circular Economy Action Plan for a cleaner and more competitive Europe

Due to the relevance of the new EU policy initiatives launched after the 1st criteria proposal, this new section aims to provide a short summary of the policy context.

The new Circular Economy Action Plan[2] (CEAP) the EU Commission foreseen a 'Circular Electronics Initiative' mobilising existing and new instruments. In particular the following actions are planned in the time period 2020-2022:

- New and or revised **ecodesign measures** for electronics and ICT computers including mobile phones, tablets and computers in order to ensure that devices are designed for energy efficiency and durability, reparability, upgradability, maintenance, reuse and recycling.

- focus on electronics and ICT as a priority sector for implementing the **'right to repair'**, including a right to update obsolete software;

- regulatory measures on **chargers for mobile phones** and similar devices, including the introduction of a **common charger**, improving the durability of charging cables, and incentives to **decouple the purchase of chargers from the purchase of new devices**;[3]

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[2] COM(2020)98 A new Circular Economy Action Plan For a cleaner and more competitive Europe

[3] On this topic an impact assessment study has been published in December 2019, focusing on mobile phones and potentially to be extended to other portable electronics https://op.europa.eu/nl/publication-detail/-/publication/c6fadfea-4641-11ea-b81b-01aa75ed71a1

- improving the collection and treatment of waste electrical and electronic equipment including by exploring options for **an EU-wide take back scheme** to return or sell back old mobile phones, tablets and chargers;

- **review of EU rules on restrictions of hazardous substances in electrical and electronic equipment** and provide guidance to improve coherence with relevant legislation, including REACH and Ecodesign.

The CEAP plan also foresees initiatives enhancing the **sustainability of the batteries**. A new legislative proposal will build on the evaluation of the Batteries Directive[4] and the work of the Batteries Alliance. Possible aspects that would be addressed are rules on recycled content, sustainability and transparency requirements, the carbon footprint of battery manufacturing, the ethical sourcing of raw materials and security of supply, and facilitating reuse, repurposing and recycling.

Furthermore, a process for the definition of the EU Ecolabel Criteria for Displays is ongoing, covering also computer monitors. A formal voting of the criteria is expected in autumn 2020. Draft criteria proposal is available at the JRC website: https://susproc.jrc.ec.europa.eu/televisions/stakeholders.html

1.2.4 Further background after AHWG meeting and first stakeholder consultation

Overall, the stakeholder welcomed the scope expansion of the criteria to smartphones. In order to deal with the increased complexity of the criteria, stakeholders requested to clarify applicability of the criteria to each product type and also to different procurement areas (e.g. device as a service) or to specific end use application (e.g. in the case of rugged devices). Also it was requested to better take into account differences between products. Clarifications were asked also about the classification of workstations that can be both stationary and mobile. Some stakeholders expressed concern about the high number of criteria, asking for a reduction and for highlighting the most relevant ones. Several stakeholders also requested clarifications on the use of specific labels as means of proof. Based on these comments, additional section has been added at the end of this report to help the reader in mapping the applicability of the

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[4]https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN#footnoteref26

criteria for the different products in the scope (section 3.1) and to guide on the use of labels as mean of proof (3.2).

In addition, it was expressed some concern about the level of ambition, considering that some of the criteria could shortly become mandatory requirements due to the revision of the ecodesign implementing measure for computers[5] and, for this reason the level of ambition in terms of environmental performance should be increased.

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[5] Regulation (EU) No 617/2013 of 26 June 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for computers and computer servers. OJ L 175 of 27 June 2013

1.3 Market analysis

This section provides an overview of the market for desktop PCs, laptops, tablets and smartphones, as well as a forecast for the next few years at global level. Additional data and estimations were collected after the first stakeholder meeting, especially regarding the market contribution of the public sector, addressed in section 1.3.3.

1.3.1 Current status and forecast for desktop PCs, laptops & tablets

The desktop PC, laptop and tablet market is generally considered as a stable, high turnover market, with over 400 million units sold globally in 2018. Despite this high level, the market has shown regressive sales numbers in the recent years (2014-2018), what can also be called a 'declining plateau' in sales (Figure 1).
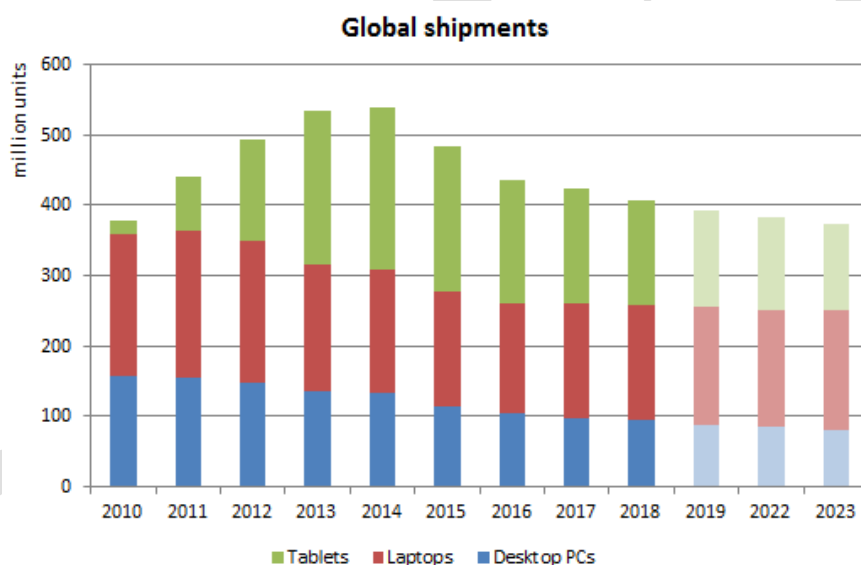
Figure 1:   Global shipments 2010-2018. 2019, 2022, 2023 are estimates[6]

In particular desktop PCs have shown a significant decline in the period 2010-2018 and are expected to have a similar pattern up to 2023. Laptops have shown a slower decline in the same period, although this product range has potential of improvement up to 2023, mainly due to the growing market of the so-called 'ultramobile' products: notebooks with 4"-7" screens.

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[6]https://www.statista.com/statistics/272595/global-shipments-forecast-for-tablets-laptops-and-desktop-pcs/ (accessed on June 2019)

Tablets, which peaked in 2014 with 230 million units sold, have shown an even faster decline since then, expecting to have a similar pattern up to 2023.

Estimates for 2020 indicate that laptops will still dominate the market with 44% of the total, with tablets still strong in the market with 29% despite regressive sales. Desktop PCs –including integrated PCs, thin clients and workstations- will account for the remaining 27% of the market (Figure 2). These numbers are not expected to change significantly between 2020-2030[7].
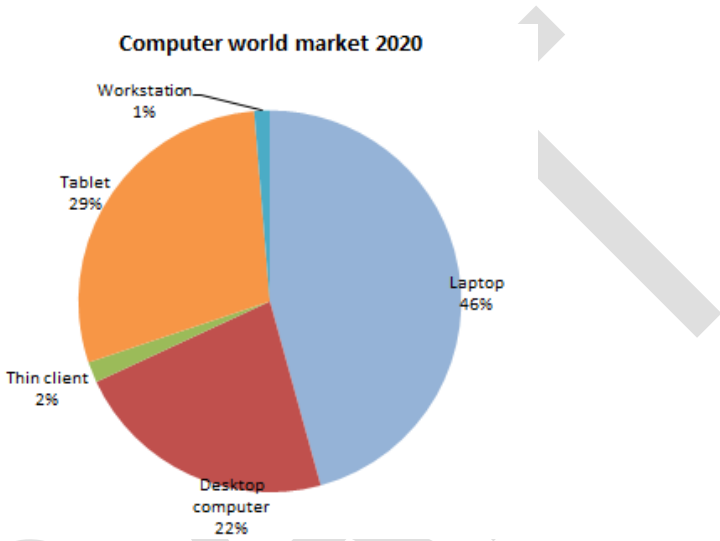
Figure 2: **Computer world market 2020[8]**

Regressive market trend for PCs, laptops and tablets is mostly explained by shifting demands of consumer and technology overlap. Consumers have adopted smartphones for applications previously provided by larger computer types. At the same time, tablet consumers seem to be moving either towards 'ultramobile' laptops – which continuously reduce their size and weight- or to smartphones –with constant increase in screen size and functionality. It is expected that demand for PCs will remain strong in business applications with faster decline in private uses, whereas laptops and tablets will remain a stronger market in private applications.

The main desktop PC vendors in 2018 were Lenovo and HP, both with 23% of the market, followed by Dell (17%), Apple and Acer (7% each) (Figure 3). A clear market trend seems to be the consolidation of big manufacturers, with Lenovo, HP and Dell showing a significant

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[7]Preparatory study on the review of Regulation 617/2017 Computers and Computer Servers – Task 7 (2017) Viegand Maagoe and Vito. https://computerregulationreview.eu/documents

[8] Preparatory study on the review of Regulation 617/2017 Computers and Computer Servers – Task 7 (2017) Viegand Maagoe and Vito. https://computerregulationreview.eu/documents

growing tendency over the past few years; together with a decrease in sales for PC makers that are not part of the top 3 (Bott, 2019).

In tablets, market is led by Apple (27%), followed by Samsung (14%), Amazon (12%) and Huawei (9%) (Figure 4). It is worth noting that Lenovo leads the desktop PC market with 23% but also accounts with 6% of tablets market. A similar situation occurs with Apple, which accounts for 7% of desktop PC market and leads the tablets market with significant distance to their competitors.
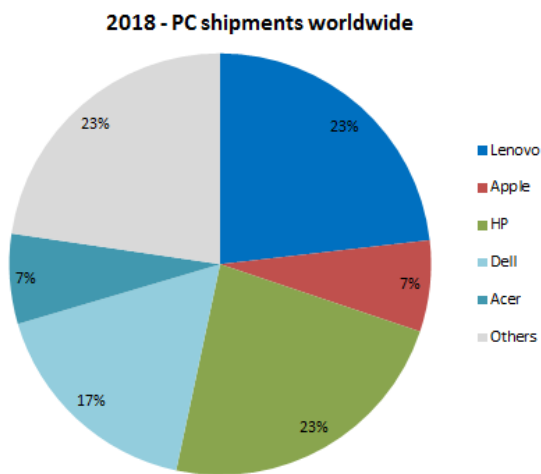
Figure 3: PC shipments by vendor 2018 (Statista, 2019b)
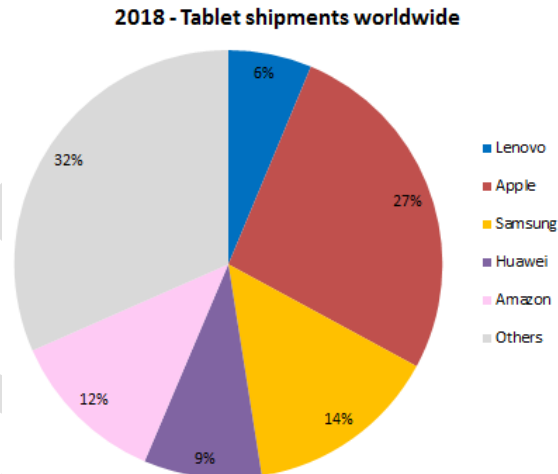
Figure 4: Tablet shipments by vendor 2018 (Statista, 2019c)

1.3.2   Current status and forecast for smartphones

Smartphones market is very strong, with more than 1.4 billion units shipped in 2018 (Figure 5). The total number of smartphones users was estimated to be around 2.5 billion in 2018. This market showed a fast-pace growth between 2010-2015, with a declining plateau since then up to 2019, similar to the one observed with the computers market[9]. Potential reasons for this decline are:

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[9] Swearingen, 2018. We're no longer in smartphone plateau. We're in the smartphone plateau. New York Intelligencer. http://nymag.com/intelligencer/2018/12/global-u-s-growth-in-smartphone-growth-starts-to-decline.html (accessed on October 2019).

- Slowing down of technologic innovation (less incentive for consumers to have latest model)

- Market saturation (90-100% in developed markets)

- Elongation of replacement cycles (due to durability, waterproofing and battery life improvements)

- Growth deceleration in some developing economies (e.g. China)
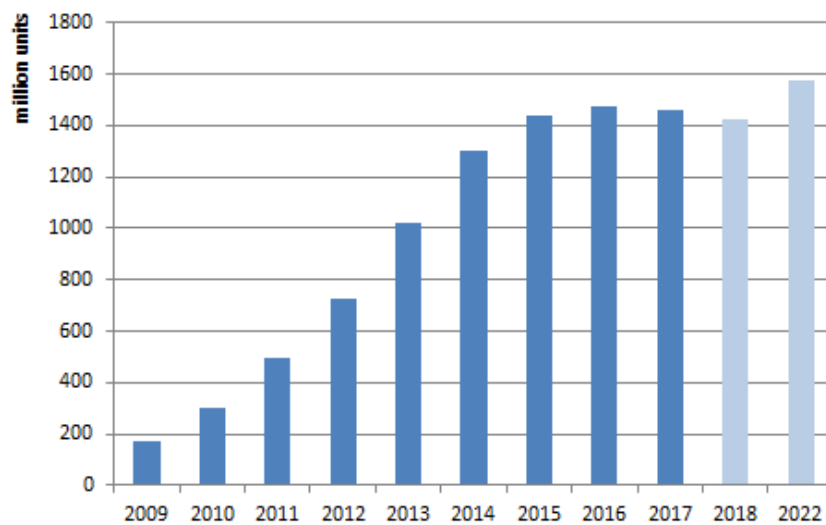
Figure 5: **Smartphone shipments worldwide 2010-2017. 2018 and 2022 are estimates[10]**

From 2019 onwards, with the progressive equipping of developing countries and the introduction of innovative technologies such as 5G (0.5% of total smartphones on that year), shipments are expected to grow again to over 1.5 billion units in 2023 (when 5G would account for 26.3% of the total).

In terms of smartphone vendors, market is led by Samsung (19%), followed by Apple and Huawei (14% each) according to data from 2018. It's worth mentioning that Huawei was the

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[10] Statista, 2018. Number of smartphone users worldwide from 2014 to 2020 (in billions), https://www.statista.com/statistics/263441/global-smartphone-shipments-forecast/ (accessed on June 2019).

only manufacturer which showed growth in 2019[11]. OEMs relatively unknown in Europe and USA such as Xiaomi, Oppo and Vivo are huge brands in China, achieving a combined 23% globally (Figure 6).

2018 - Smartphone shipments worldwide
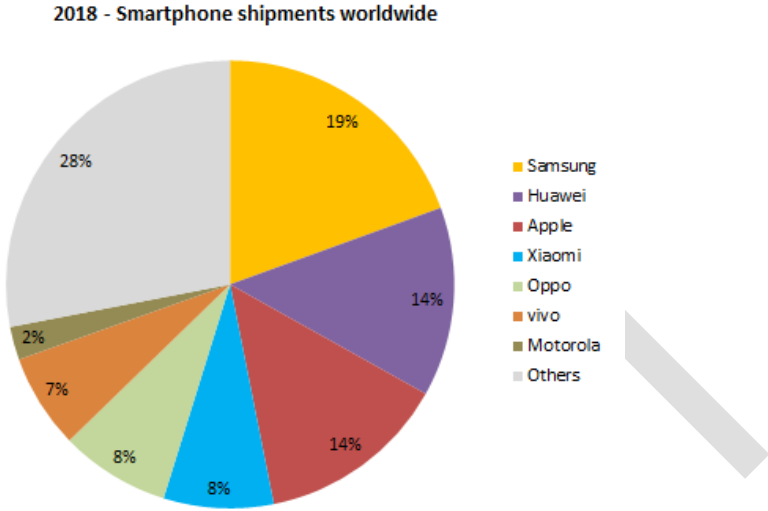
Figure 6: **Smartphone shipments worldwide by vendor – 2018 Q1[12]**

Considering PCs, tablets and smartphones combined, Apple seems to be the only brand with significant presence in every market (7%, 27% and 14%, respectively). Samsung is a big actor both in tablets (14%) and smartphones (19%), similarly to Huawei (9% and 14%, respectively).

1.3.3   Contribution of the public sector in the EU market.

The total value of reported ICT public procurement contracts in the EU was estimated to be about EUR 50.3 billion in 2011[13]. According to this study, service contracts represent 60% of the ICT total contract value, while only 25% is spent on supplies. Estimations about the public

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[11] IDC, 2019. Smartphone shipments experience deeper decline in Q1 with a clear shakeup among the market leaders. https://www.idc.com/getdoc.jsp?containerId=prUS45042319 (accessed on June 2019)

[12] IDC, 2019. Smartphone shipments experience deeper decline in Q1 with a clear shakeup among the market leaders. https://www.idc.com/getdoc.jsp?containerId=prUS45042319 (accessed on June 2019)

[13] DG Communications Networks, Content & Technology (2011). Quantifying public procurement of R&D of ICT solutions in Europe SMART 2011/0036 estimates, ISBN 978-92-79-40167-1 DOI 10.2759/76021

market value for ICT in 2019 have been shared by Bechtle during the consultation process (Table 2 below). In the countries analysed the ICT public expenditure per person vary from the around 90 Euros for UK and Spain up to more than 200 Euros for France and Ireland.

Table 2: Estimated ICT Market value in different EU and non-EU Countries.
Source: Bechtle AG

Country	Overall ICT Market value (in Million €)	Estimation for Public Sector (in Million €)	Ratio Public to Total	Population (Million)	Public spend on ICT per head (in € / person)
UK	15,318	6,000	39%	67	90.12
Switzerland	29,354	1,300	4%	8.5	152.18
Spain	48,199	4,000	8%	46	87.50
France	60,900 €	17,400	162%	66	264.77
Belgium	20,029€	2,000,	10%	11.5	171.79
Ireland	8,860	1,000	11%	4.7	210.35
Netherlands	41,035	3,000	7%	17	174.49
Austria	13,496	1,200	9%	8.8	136.22

In the framework of this study for the revision of the EU GPP Criteria of Computers and Monitors, the contract notices available on the Tenders Electronic Daily (TED) website[14] were screened from mid-May to mid-June 2019 (Figure 7). The tenders classified under the Common Procurement Vocabulary (CPV) 30200000 'Computer equipment and supplies' were analysed. Among the 102 tenders identified, only 54 reported their economic value. The value of the remaining tenders has been estimated accordingly to average value of the contracts identified. A total of 276 million of euros has been calculated as economic value for the tenders related to computer equipment and supplies in Europe in this period of time (mid-May to mid-June 2019).

However this estimation clearly represents only a small fraction of the budget that EU public authorities allocate to the procurement of ICT products and services as 1) the obligation of publishing the tender on the TED website is only for procurements above a certain financial threshold and 2) a relevant share of budget is dedicated to ICT services (CPV 72000000) and software (CPV 48000000) that are not included in this estimation.

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[14] https://ted.europa.eu/

Overall, it is clear that the relevance of the public sector in the EU ICT market and the potential important impact of GPP in driving the change toward a greener ICT sector.

Tenders with values, abs.	54
Tenders with values, share	53%
Total of 54 Tenders with value	146.587.112,58 €
Average value/tender	2.714.576,16 €
lowest value	17.830,00 €
highest value	41.250.000,00 €
Extrapolation from 54 to 102 tenders, total	276.886.768,21 €

Figure 7: Analysis of tenders in the period mid-May to mid-June 2019. Above: business sectors analysed. Below: calculation of the estimated value.

1.4 Environmental impact analysis

In this section, the main environmental impacts of ICT devices under the scope of this revision are outlined. Focus will be on broadly understood and reported impact categories such as Global Warming Potential or Energy consumption, although other categories might be referenced if relevant. The aim of this section is to serve as a basis for the subsequent definition of GPP criteria. In terms of relative contribution to life cycle GHG emissions, a study

from the McMaster University (Canada)[15] provides a comparison of different ICT products categories.

A key finding of the study was the increasing contribution of smartphones to the total ICT footprint. The authors found that by 2020, the relative contribution of smartphones will surpass the impact (in terms of global warming potential and energy consumption) of desktop computers, laptops and displays, due to the increasing number of smartphone in the market.

As a general conclusion, similar environmental patterns have been identified for the different ICT end-user devices, and therefore similar strategies may be implemented to reduce their environmental impact, prioritising their lifetime extension and circularity.

1.4.1   Desktop computers and notebooks

When assessing the environmental impacts of desktop computers and laptops, there is general consensus among researchers conducting Life Cycle Assessment (LCA) studies: the life cycle stages with the most significant impacts are manufacturing and use, particularly when analysing Energy consumption and Global Warming Potential[16], although the relative importance between these two differs between product types (e.g. desktop computers and notebooks). Looking at Figure 8 it appears that the dominant contributor to Green House Potential impact is the manufacturing stage.

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[15] Belkhir L, Elmeligi A. (2018). Assessing ICT global emissions footprint: Trends to 2040 &recommendations. Journal of Cleaner Production 177 (2018) 448-463

[16] Arushanyan et al. (2014) Lessons learned. Review of LCAs for ICT products and services. Computers in Industry.
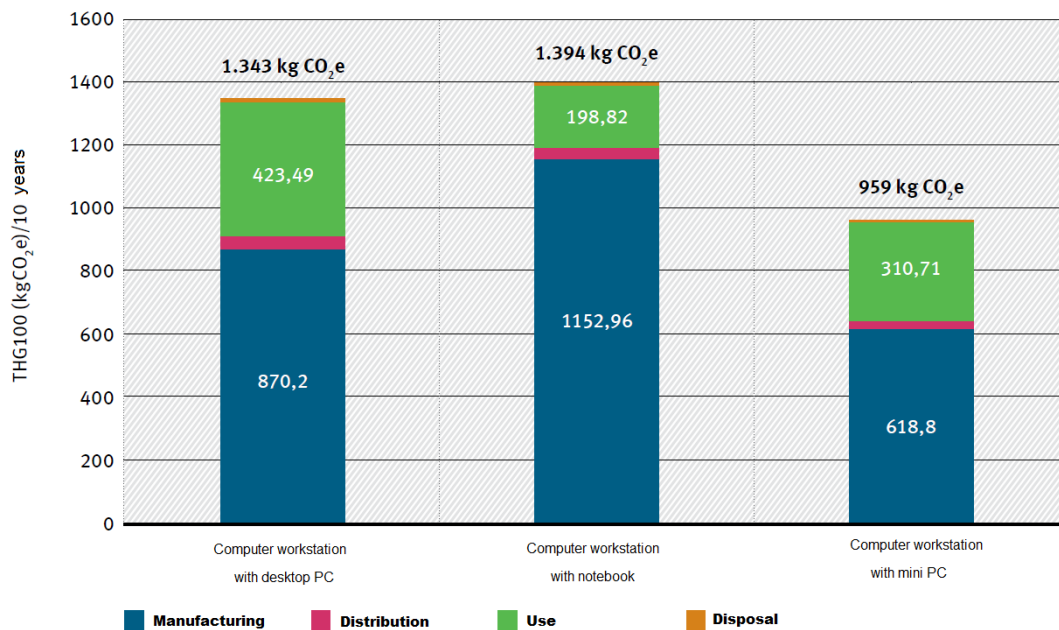
Figure 8:   **Comparison of the total greenhouse gas potential (THG100) of the three computer workplaces (values rounded, without recycling credits)[17]**

Focusing in the manufacture of specific components, those with the highest contribution in computers are printed circuit boards (PCBs), due to the large energy required in producing the active components (semiconductors) as well as the impact caused in the mining and processing of minerals such as gold.

Production of PCBs and Integrated Circuits (ICs) is known as a process with substantial energy and resource use, considered among the highest environmental impact per mass of unit. Generally, the higher the performance of a computer in terms of processing capacity or memory, the larger the content of PCBs and ICs. Therefore, measures aimed at helping organizations make the right choice in terms of performance of ICT equipment that they purchase, will have a significant positive impact on their overall footprint.

From environmental perspective, another relevant component of desktop computers is the monitor. Considering the whole lifecycle impact of an average desktop computer, manufacturing of the monitor can account for 26% of total GHG lifecycle emissions. If we

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[17] Prakash et al. (2016) Computer am Arbeitsplatz: Wirtschaftlichkeit und Umweltschutz - Ratgeber für Verwaltungen. Umweltbundesamt

consider the impact of the use phase of the monitor, that adds to a combined 33% of lifecycle emissions[18].

Still related to the use phase, it's worth introducing the concept of 'rebound effect', which can be defined as an indirect, non-intended negative consequence of a specific strategic decision. For example making use of very energy efficient equipment does not guarantee that the net emissions of an organization will be lower. For example, a typical rebound effect could be that procuring high efficient computers and monitors the organizations could taking less care about shutting down computers and monitors at the end of working day.

Overprovisioning can also be a cause of negative environmental effects. For example, if an organisation decides to purchase more ICT equipment than it actually needs (or with a processing capacity / memory much higher than needed), it would result in a higher net environmental impact. It therefore important that the devices they are purchased (and used) are fit-for-purpose for their activities or the number of devices they acquire does not exceed their actual needs. The net "worst-case" effect of user-determined factors is the high-power multi-display system (Figure 9:   Multi-display use). A system such as this could increase the energy consumption even with high-efficient devices[19].

Figure 9:   Multi-display use

Another life cycle stage frequently considered in LCA studies is the end of life, and it usually highlights the potential positive benefit of reusing and recycling strategies. Specifically on reuse, a study[20] highlights the potential benefit of using laptops in a secondary application,

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[18] Andrae (2013) Comparative LCA of physical and virtual desktops. Journal of Green Engineering.
[19] Nathaniel Mills & Evan Mills (2016). Taming the energy use of gaming computers. Energy Efficiency (2016) 9:321–338. DOI 10.1007/s12053-015-9371-1

[20] André et al. (2019) Resource and environmental impacts of using second-hand laptop computers: A case study of commercial reuse. Waste Management

resulting in a 40% reduction in GHG emissions. Another study[21] points in the same direction with regards to lifetime extension of laptops: increasing it from 3 to 5 years can reduce organization GHG emissions by 37%.

Transport and logistics stages seem to have the lowest environmental impact for these types of products. These stages are generally affected by the size and mass of items to be transported. Therefore, simplification and light-weighting of packaging elements will have a positive (but limited) contribution to the lifecycle impact of ICT products.

Several LCA studies indicate environmental benefits of laptop reuse and second-hand laptops provided by a real commercial reuse company, instead of new ones [22,23]

1.4.2   Tablets

In the case of tablets, a similar pattern to computers can be observed. Most of the impact happens in the manufacturing stage, with a considerably lower burden associated to use stage[24]. As in the case of computers, PCBs and ICs are responsible for the majority of the embodied GHG emissions in tablets, even taking into account that these components represent a small percentage of their mass. The overall impact of product casings is generally small unless it includes energy intensive materials such as magnesium.

The tablets market has evolved over the years towards smaller, even more portable devices, which are actually hybrids between smartphones and tablets –products also known as 'phablets'. Studies indicate that phablets have a lower environmental impact than tablets,

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[21] The shift project (2019) Lean ICT – Towards digital sobriety

[22] André H, Ljunggren Söderman M, Nordelöf A, (2019) Resource and environmental impacts of using second-hand laptop computers: A case study of commercial reuse. Waste Management 88 (2019) 268–279

[23] Prakash, S., Kohler, A., Liu, R., Stobbe, L., Proske, M., Schischke, K., IEEE, 2016. Paradigm Shift in Green IT – Extending the Life-Times of Computers in the Public Authorities in Germany. 2016 Electronics Goes Green 2016+ (Egg), 7.

[24] Apple, (2019) iPad Air Product Environmental Report.
https://www.apple.com/environment/pdf/products/ipad/iPadAir_PER_Mar2019.pdf (Accessed on October 2019)

although distribution of impact among life cycle stages is similar, main ones being manufacturing and use stage[25].

Displays also have a significant contribution due to the high energy needed to produce them. It's worth noting that GHG emissions of displays usually correlate with size[25]. Size is therefore a relevant factor to consider when evaluating the environmental impact of devices. Studies point out that generally, the lower the size and mass of the device, the lower will be its footprint. Similarly, impact of mobile devices such as tablets or phablets is very small when compared to laptops or desktop PCs. This brings to the table the concept of right-sizing. If the main tasks to be performed with a device can be satisfactory done with a mobile device, from GHG emissions perspective it is worth acquiring a tablet (or a notebook) rather than a desktop PC. Often consumers own both types of appliances, creating a rebound effect.

In terms of technology, it has been observed that modern devices have fewer ICs and PCBs, a consequence of higher levels of on-chip integration enabled by Moore's law. Considering that these are the components with the highest impact, this suggests that if an organisation does need to purchase new ICT equipment, from the environmental perspective it is worth investing in modern devices[26].

Accessories such as chargers and cables are an important aspect to consider in mobile devices. Standardization and interoperability can allow the implementation of strategies to reduce the redundancies of these accessories (e.g. the same charger/cable used for different equipment or reused at the end of the life of the equipment).

1.4.3   Smartphones

Considering GWP as a relevant indicator, the most significant environmental impact of smartphones happens in the Manufacturing stage: 75% of total impact for a 2015 common smartphone. In terms of specific components, the largest contribution is from the ICs, which

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[25] Stutz (2011) Carbon Footprint of the Dell Streat Tablet. http://i.dell.com/sites/content/corporate/corp-comm/en/Documents/dell-carbon-footprint-streak.pdf (Accessed on Ocotber 2019)

[26] Teehan et al. (2013) Comparring embodied Greenhouse Gas Emissions of modern computing and electronics products. Environmental Science & Technology.

accounts for 58% of the total life cycle impact[27]. Another component with significant contribution to GWP is the display, with 6% of the total impact. As it is with the case of tablets, devices with larger displays tend to have a higher environmental burden. From an organizational perspective, making the right choices in terms of smartphone capabilities and display size can help to reduce the overall environmental footprint.

In terms of the use phase, studies indicate that using the phone with an average frequency over a period of 3 years accounts for 13% of the total contribution to GWP[27.] Moreover, current usage trends, with an ever-increasing use of applications, cause a net growth in energy use: although modern smartphones have batteries with larger capacities, they are recharged equally or even more often due to this intensive use of applications[21].

An important aspect to take into account in smartphones is the potential impact of the infrastructure needed. The functioning of these devices relies heavily on internet connection and therefore need a complex infrastructure to work: servers to store data generated and networks to be able to transfer it. When accounting the environmental burden of smartphones, the additional impact of infrastructure needs to be accounted as well. As a general figure, a study[28] suggests that 1 server is required for each 400 smartphones. In that study, it is highlighted that the footprint of a smartphone may be doubled if the impact of the associated infrastructure was properly accounted for. This argument on network infrastructure is also valid for desktop computers, notebooks and tablets, where more and more data is stored and processed in the Cloud. Organisations have to take into account this aspect when making decisions regarding acquisition of ICT equipment/services: the impact of the devices comes with an additional impact on 'hidden' infrastructure.

Redundancy of devices is another aspect contributing to the impact of the ICT equipment, like smartphones. Initiatives which consists in combining personal and professional uses in the same terminal (using smartphones with two SIM cards), can help to reduce GHG emissions of an organization. Studies indicate that increasing these initiatives can help cut their emissions[21].

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[27] Ercan et al. (2016) Life cycle Assessment of a Smartphone. ICT for Sustainability.

[28] Suckling et al. (2015) Redefining scope: the true environmental impact of smartphones? International Journal of Life Cycle Assessment.

Although replacement cycles are elongating, consumers still tend to switch their smartphones for newer models even if the former ones are still in good condition. This is also pushed by the fact that new versions of operating systems are often not compatible with older generation smartphones, causing degraded performance and reduction in useful capacity of battery. This quick replacement cycles lead to a non-efficient use of resources, since materials and energy invested in manufacturing devices are not fully exploited. Some might argue that faster replacement cycles of smartphones might be beneficial, as society might benefit from energy efficiency improvements of new generation mobile phones. However, certain studies highlight that, even assuming 20% improvements in phone efficiency every 4 years, after 10 years of life, it would still be more sustainable to use an old phone[29]. Similar findings, but at a larger scale, where obtained for notebooks, were even if a new notebook uses around 10 percent less energy than an old one, it would have to remain in service for around 80 years in order to compensate for the energy consumed in its manufacture[17]. Annual efficiency improvement has to be very high to justify a new ICT equipment for environmental reasons. It is paramount to encourage activities which enable lifetime extension of ICT devices. In the case of smartphones, it has been estimated that increasing its lifetime from 2.5 to 3.5 years allows reducing GHG emissions by 26%[21].

It's also important to highlight the intensive use of rare metals in smartphones (as well as in notebooks and tablets): Indium in touchscreens and displays; cobalt and lithium in batteries; gold, silver, platinum, tantalum, tungsten and copper in electronic boards; etc. There are several environmental issues potentially related to the use of rare metals. Most of them are produced in highly unstable countries or monopolistically by superpowers (supply risks and pressure on prices) which classifies them as Critical Raw Materials (CRM). They are also a source of soil pollution and ecosystem disturbance during extraction (it has been estimated that it is necessary to disturb 40 times more volume of an ecosystem than the volume of the actual device). They tend to generate large amounts of GHG emissions and some of them also have a large contribution in other impact categories such as Human Toxicity, Ecosystem Toxicity, Abiotic Depletion Potential and Eutrophication.

Appropriate end of life initiatives aimed at the recovery of those valuable materials have the ability of reducing in an important manner the impact caused by those minerals. In the case of

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[29] Frey et al. (2006) Ecological footprint analysis applied to mobile phones. Massachusetts Institute of Technology and Yale University.

smartphones, consumers tend to store them for long periods of time before deciding what to do with them at end of life. This might have a positive as they are diverted from negative waste management options such as landfilling, as long as the devices are safely stored in consumers' properties. However, it has been demonstrated that retention of the devices for an extended period after their use reduces their value to any secondary markets[28]. Therefore, it is important to encourage initiatives to recover valuable materials of smartphones, and other ICT equipment, as soon as the devices have concluded their useful life.

In general, dealing with ICT equipment appropriately at end of life can have a significant beneficial effect on impact categories other than GWP, such as Human Toxicity or Freshwater Ecotoxicity. Computers, tablets and smartphones have several valuable materials that can be recovered at end of life, diverted from landfills and used again in other devices. Glass of LCD screens can be recycled. Aluminium alloys and plastics in casings can be sorted, shredded and recycled. PCBs can be manually sorted, their precious metals recycled and their plastics incinerated with energy recovery. If easily detachable, batteries can be manually sorted and their constituent components recycled. Avoiding the use of chemicals that could influence the ability to recycle components of ICT equipment is also an aspect to consider. A study[30] points out that considering Freshwater Ecotoxicity, up to 30% improvements can be achieved by recovering a significant amount of valuable materials at end of life. This improvement is up to 90% when considering Human Toxicity.

1.5   Procurement routes

When public organisations procure stationary and/or mobile ICT equipment and/or services, these are typically fitting within one of the following routes:

- Purchase of devices only, in these cases the public organisation should have a dedicated ICT team which deals with the issues related to the purchased products (e.g. maintenance, repair, upgrade, etc.)

- Purchase of devices and ICT services, in these cases the public organisation outsources the ICT services associated to the usage of the purchased devices (e.g. maintenance, repair, upgrade, etc.)

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[30] Arduin (2017) Life cycle assessment of end of life scenarios. Tablet case study. Sixteenth International Waste Management and Landfill Symposium. Proceedings Sardinia 2017

- Purchase of Devices as a Service (DaaS), in these cases the public organization pays a periodical subscription fee to lease an endpoint hardware and management services from the tenderer.

The procurement routes should be defined based on the procurement needs of public organisations. Figure 10 illustrates some examples on the assumed routes based on current knowledge on the market.

Although the procurement of "refurbished" (also called "reconditioned") and remanufactured products is currently not a common procurement route in the public sector, chapter 2.5 of this report presents possible green criteria applicable to this procurement route.

In this context of this report the term refurbishment is defined as the "treatment or a modification of a product, or parts of a product, to increase or restore its performance and/or functionality or to meet applicable technical standards or regulatory requirements, with the result of making a fully functional product to be used for a purpose that is at least the one that was originally intended". The term remanufacturing, instead, indicate a treatment or modification of a product, or parts of a product, in industrial processes to restore it to original as new condition and performance, or better. [31]

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[31] Cordella et al., (2019) Improving material efficiency in the life cycle of products: a review of EU Ecolabel criteria. The International Journal of Life Cycle Assessment · March 2019. DOI: 10.1007/s11367-019-01608-8
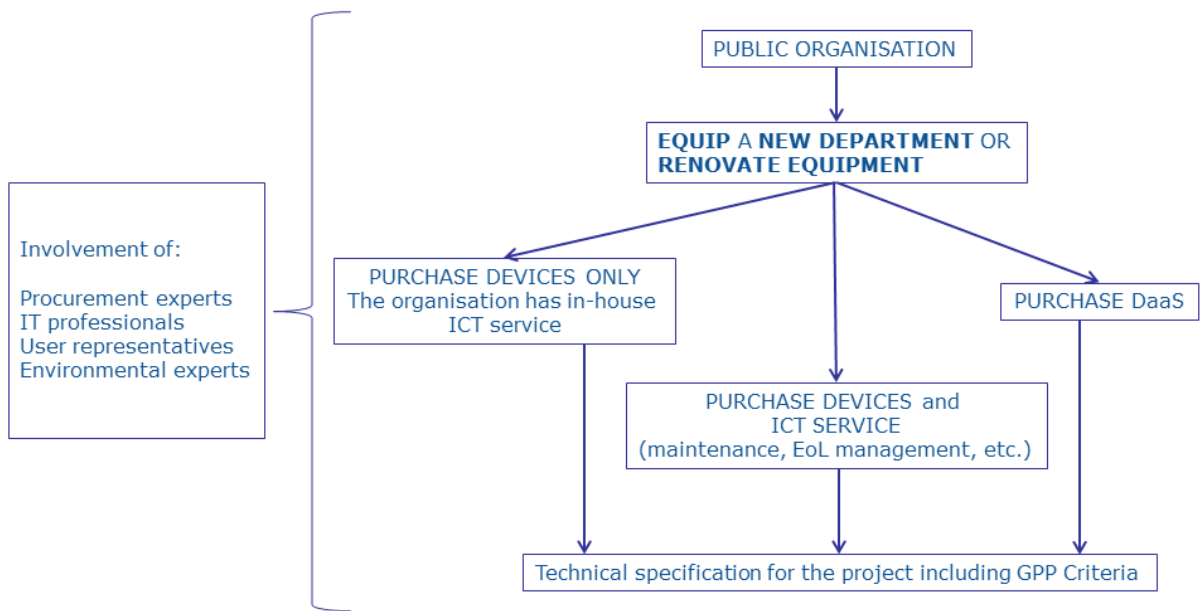
Figure 10: **Possible procurement routes identified for public organisations**

2 DRAFT CRITERIA AREAS AND PROPOSALS

The order of the criteria area has been revised in this second draft of the report. The aim is to better highlight criteria aiming to extend the product lifetime, which can provide both environmental and lifecyle cost benefits. The numbering of the criteria has been kept as for the first draft, in order to make easier the comparison of the criteria in Draft1 and in Draft2.

2.1 Criteria area 1 – Product lifetime extension

2.1.1 Criterion 1.1 – Reparability, Reusability and Upgradeability

Compared to the current set of criteria (GPP 2016) the following criteria are proposed to be removed:

- The TS on the ease of replacement for rechargeable batteries as it is covered by the criterion on a more general level of design for reparability.

- The AC on cost competitiveness of spare parts as this aspect should be considered as an element of the Life Cycle Costing calculation and not as a quality aspect.

- The AC on longer warranty as this has to be defined according to the public administration needs and it should be clearly specified in the tender.

- The ACs on Tablet and all-in-one notebook memory and storage, considered that this aspect is already covered in the design for reparability criterion and the current criterion could, in some way, restrict the market.

Moreover, the criteria on warranty and service agreement has been reformulated to more specifically focus on service agreements associated to the procurement of equipment or Device as a Service (DaaS) business models; it is also proposed a related CPC in order to periodically report on the compliance with the service agreement.

A new technical specifications have been proposed in order to increase the reusability of products on the provision of software for secure data erasure.

The following table compares the existing GPP criteria with the new proposals.

Table 3:   Reparability, reusability and upgradeability current criteria (2016) and TR v2.0

GPP 2016	TR v2.0 Proposal
TS4. Warranty and service agreements	TS6. Provision of an extended warranty

TS5(a) Continued availability of spare parts	TS7(a) Continued availability of spare parts
TS5(b) Design for repairability	TS7(b) Design for reparability
TS5(c) Ease of replacement for rechargeable batteries	
	New! TS8 Refurbished Products Deleted here and included as "Criteria area 5 – Criteria proposals for refurbished products", cf. section 2.5
	New! TS9. Functionality for secure data deletion
AC2. Cost competitiveness of spare parts	
AC3. Longer warranties and services agreements	
AC4. Tablet and all-in-one notebook memory and storage	
	CPC1 Service Agreement

Summary of the main changes after the first stakeholder consultation

Main changes introduced are related to the classification of criteria as core / comprehensive level: criteria on service agreement (TS6a), manufacturer warranty (TS6b) and availability of spare parts (TS7a) were modified to provide more flexibility in terms of threshold applied. Criterion TS7b on design for reparability was split in two: a core level generally ensuring that repair is not prevented and a comprehensive level where disassembly can be carried out by the use of basic tools. Clarifications on the use of ecolabels as proof of compliance are introduced for all the criteria. The proposal for refurbished / remanufactured products is moved to section 2.5. More details of the changes implemented are provided in Section **Error! Reference source not found.**. The following table shows the criteria as revised after the AHWG meeting and the first stakeholder consultation.

Second criteria proposal	
Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATIONS	
TS6 (a). Provision of an extended services agreement *(same for core and comprehensive)* *Applicable to all the categories of devices in case of:* • *Service agreements associated to the supply of the ICT equipment, or* • *Provision of Devices as a Service.*	

The tenderer must provide X years [*minimum 2, to be defined*] of services as detailed in the Service Level Requirements document (see explanatory note below).

Verification:

The tenderer must provide a written declaration that the products supplied will be warrantied in conformity with the contract specifications and the related service level agreement.

EXPLANATORY NOTE: Examples of Service Level Requirements

A Service Level Requirements document describes how the service should be delivered to the customer. Examples of possible Service Level Requirements to be included are listed below:

- Access to the Manufacturer's warranty: register the manufacturer's warranty; manage any documentation or proof required to invoke Manufacturer Warranty; invoke the Manufacturer Warranty on behalf of the Public Administration (during the Manufacturer Warranty's duration); follow up with the manufacturer in order to ensure that the terms of the Manufacturer Warranty are met;

- Pick up and return: pick-up the product(s) from a specified location at the Public Administration premises and return it/them to a specific location at the Public Administration premises.

- Management of failures: the provision of an efficient single point of contact for technical issues and problem escalations, a person responsible of following through the progress of the case, reporting, transparent access to a warranty database (whomever manages this warranty data) to verify warranty status, incident status for open incidents.

- Access to diagnostic and repair tools: access to all technical tools available to the tenderer to perform hardware diagnostics and corrections; access to any technical training required to become a certified repair technician; non-exclusivity to become a certified technical partner (perform warranty repairs).

- Battery coverage: the service explicitly covers battery defects for applicable products with rechargeable batteries as failure to charge or faulty battery connection. A progressive drop in battery capacity due to usage must not be considered to be a defect unless it is covered by the battery replacement policy of the bullet below.

- Battery replacement policy: the service covers replacing batteries not fulfilling the minimum performance conditions related to endurance in number of cycles

- Provision of failure statistics provision of a high level, aggregate, anonymized and not traceable back statistics of incident types in nature and quantities, problems and diagnostics concerning the products in the scope of the contract

- Incident management / Problem management / Preventive maintenance: this service include all the operations necessary to maintain the ICT products in perfect working order, or to restore a defective product or one of its components to perfect working order, including incident management, problem management and preventive maintenance. Preventive maintenance during the warranty period includes ensuring OS and security updates for the duration of the contract.

- Upgrading: a scan for upgrading possibilities can take place after a certain period (e.g. 3 years) and cover performance aspects like CPU/Memory/Disk.Repair / Replacement activities: repair or replace any products which become damaged or defective in the course of normal use during the Extended Warranty period with products which have identical or better performance characteristics. Breakdowns related to firmware are also covered. If part of an item is replaced, the replacement part must be covered by the same Extended Warranty level and duration as the replaced part. The Extended Warranty applies to both hardware and software, unless explicitly agreed otherwise

- Commitment to Repair / upgrade as first remedy: in case of failures and, whenever technical feasible, the service provider commits to provide the option of a repair / upgrade of the equipment instead of an equipment substitution.

TS6(b) Manufacturer's warranty

(same for core and comprehensive)

Applicable to all the categories of devices

The tenderer must provide products covered by X years [*minimum 2, to be defined*] of manufacturer's warranty.

Verification:

The tenderer must provide written evidence of the manufacturer's warranty

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TS7(a) Continued availability of spare parts

(same for core and comprehensive)

Applicable to all the categories, in case of:
- *Service agreements associated to the supply of the ICT equipment, or*
- *Provision of Devices as a Service.*

This criterion is not relevant in case it is already covered by the TS6(a).

The tenderer must guarantee the availability of spare parts (critical components), including as a minimum those identified in criterion TS7(b), for X years [*minimum 2, to be defined]* from the date of purchase.

The spare parts/replacement components can be:

- A like-for like used part

- A new or used OEM part conform specifications

- An After Sales (third party) part, conform specifications.

All critical components identified must be:

- available to be purchased

- or replaced by a service network for repair and maintenance.

Verification:

The tenderer must provide a declaration that critical components will be available for each model provided.

Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.

TS7(b) Design for reparability	**TS7(b) Design for reparability**
Applicable to all the categories of devices	*Applicable to all the categories of devices*
The tenderer must ensure that joining or sealing techniques applied to the products supplied do not prevent the replacement of the parts (critical components) listed below:	The tenderer must ensure that the following parts (critical components) must be easily accessible and replaceable by the use of basic tools (class A) as defined according to the EN 45554:2020 (see the explanatory note) below:
• Notebooks: Battery. Display Panel/Display assembly, Storage (SSD, HDD, RAM), External/internal PSU, Keyboard, System/motherboard	• Notebooks: Battery. Display Panel/Display assembly, Storage (SSD, HDD, RAM), External/internal PSU, Keyboard, System/motherboard
• Desktops: CPU, GPU (PCIe), External/internal PSU, Storage (SSD, HDD, ODD, RAM), System/motherboard	• Desktops: CPU, GPU (PCIe), External/internal PSU, Storage (SSD, HDD, ODD, RAM), System/motherboard
• All-in-One PCs: External/internal PSU, Storage (SSD, HDD, ODD, RAM), System/motherboard	• All-in-One PCs: External/internal PSU, Storage (SSD, HDD, ODD, RAM), System/motherboard
• Tablets: Battery, Display Panel / Display assembly, External/internal PSU	• Tablets: Battery, Display Panel / Display assembly, External/internal PSU
• Smartphones: Battery, Display Panel/Display assembly, Charger	• Smartphones: Battery, Display Panel/Display assembly, Charger
• Displays: Connectivity cables, Power cables, External PSU	• Displays: Connectivity cables, Power cables, External PSU

Note: Onboard soldered CPU´s are excluded from the critical component list.	Note: Onboard soldered CPU´s are excluded from the critical component list.
Instructions on how to replace the parts must be provided with the service manual. The manual must include security measures to be taken to ensure a safe repair, an exploded diagram of the device illustrating the parts that can be accessed and replaced (that could be provided also in the form of a tutorial video), and the tools required. The service manual must be available online for anyone to read, free of charge.	Instructions on how to replace the parts must be provided with the service manual. The manual must include security measures to be taken to ensure a safe repair, an exploded diagram of the device illustrating the parts that can be accessed and replaced (that could be provided also in the form of a tutorial video), and the tools required. The service manual must be available online for anyone to read, free of charge.
Verification:	**Verification**:
The tenderer must provide:	The tenderer must provide:
• Statement that the applicable parts are replaceable by the end-user and/or technician.	• Statement that the applicable parts are replaceable by the end-user and/or technician.
• The service manual with the Instructions on how to replace the parts by a direct link to the document on the manufacturer's website. Repair information must be provided according to EN 45559 (methods for providing information relating to material efficiency aspects of energy-related products).	• The service manual with the Instructions on how to replace the parts by a direct link to the document on the manufacturer's website. . Repair information must be provided according to EN 45559 (methods for providing information relating to material efficiency aspects of energy-related products).
Equipment holding a Type I Eco-label fulfilling the specified requirement will be deemed to comply.	Equipment holding a Type I Eco-label fulfilling the specified requirement will be deemed to comply.
In particular holding the following labels is considered as proof of compliance:	
• TCO Certified, Generation 8	

EXPLANATORY NOTE: Classification of Tools according to the EN45554:2020

According to the EN45554:2020 a part is replaceable by Class A tools if the disassembly is feasible with:

- The use of no tools

- A tool or set of tools or set of tools supplied with the product or with the spare part

- Basic tools as listed in Table A.3 of the standard

New! TS9. Functionality for secure data deletion

Applicable to all the categories of devices except computer displays

Functionality for secure data deletion must be made available for the deletion of data contained in all data storage devices of the product (see also explanatory note). Instructions on how to use this functionality, the techniques used and the supported secure data deletion standard(s) must be provided in the user manual.

Verification:

The tenderer must provide specifications of the data erasure functionality provided with the product. Relevant reference for compliance can be the NIST 800-88 Revision 1 guidelines, for the level of "Clear", or equivalent.

Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.

Labels currently fulfilling this requirement include among others TCO Certified Generation 8.

EXPLANATORY NOTE

A functionality for secure data deletion could be implemented by means of technical solutions such as, but not limited to:

- a functionality implemented in firmware, typically in the Basic Input/Output System (BIOS),

- a functionality implemented in the software included in a self-contained bootable environment provided in a bootable compact disc,

- digital versatile disc or universal serial bus memory storage device included with the product, or in software installable in the supported operating systems provided with the product.

CONTRACT PERFORMANCE CLAUSES

CPC1 Service Agreement

To be used in conjunction with the TS6a on Service Agreement

The tenderer must provide periodical [monthly / annually] reporting on its compliance with all the metrics, Key Performance Indicators and other indicators defined by the Service Level Agreement

EXPLANATORY NOTE: Examples of Key Performance Indicators (KPIs)

- Aggregate KPI 1 – Incident solved: number of incidents resolved within the incident resolution time during a month / total number of incidents opened during the given month or opened during a previous month and still pending. Monthly target: ≥90%.

- Aggregate KPI 2 – Commitment to repair as first remedy: number of incidents resolved within a product repair or upgrade / number of incidents resolved within a product replacement.

2.1.1.1   Initial background and rationale for the proposed criteria

Provision of Extended Service Agreement

A service agreement can be beneficial from the environmental point of view whenever it contributes to extend the product lifetime. A service agreement should not be considered as way to effectively replace not functioning products, rather it should be considered as a tool to efficiently manage the ICT fleet in the public administration. For this reason, a service agreement should include warranty services. Requirements on an efficient diagnostic and management of the failures, access to the manufacturer's warranty, maintenance and preventive actions should be part of a service agreement covering the expected ICT asset life.

For the revision of the GPP criteria it has to be considered that in praxis service level requirements vary widely. The criteria have been splitted in two TS:

- one technical specification requiring the provision of services reflecting common available service models covering both hardware and software support. Environmental benefits can be amplified in case of "commitment to repair as first remedy", as reported in the Repair Scoring System study of JRC[32].

- A second technical specification requiring the provision of products with manufacturer's warranty.

A contract performance clause (CPC1) is proposed to be added in order to lay down specific requirements relating to the monitoring and periodically reporting of the quality of the service contract, in particular regarding aspects as the number of incidents solved and percentage of incidents resolved with product repair.

The length of a service agreement period should be based on the expected useful life / duration of the procurement cycle. Useful life can be different between product categories and can be also affected by aspects like procurement and technical needs and budget availability. Moreover the length of the service agreement is not necessarily linked to the useful lifetime of the product as a separate tender for support, maintenance and repair could be periodically launched and ensure continuity of the service.

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[32]See
http://publications.jrc.ec.europa.eu/repository/bitstream/JRC114337/jrc114337_report_repair_scoring_system_final_report_v3.2_pubsy_clean.pdf

it is proposed to keep 2 years as minimum length for a service agreement (core level), while the length is kept open longer periods based on the specific needs and context.

Manufacturer warranty

The manufacturer warranty has been included in the revised GPP requirements but separated from the service criteria. The main reason for splitting these aspects is because bidders in public procurement processes for IT service/products are often service providers and they are not the manufacturers (OEMs) of IT equipment delivered.

Among the analysed ecolabels, only TCO Certified applies requirements on warranties (for at least one year) provided by the manufacturer. This means, that current EU GPP criteria are far more challenging by requiring at least a product warranty of two years (core criteria) or three years (comprehensive criteria), with the possibility to acknowledge extended warranties with additional points for each additional year of warranty beyond the minimum technical specification through applying award criteria. Further, the current comprehensive GPP award criteria include extra points if rechargeable battery replacement is provided free of charge within the first three years in case of capacity loss of more than 50 percent. However, according to some feedback from the stakeholder consultation, the three-year warranty was considered to be very challenging whereas the 2 years requirement was considered reasonable in the EU context. The current EU GPP criteria do not specify either the coverage of the warranty, i.e. which components should be included (besides battery defects) or may not be excluded.

For comparison, the reparability scoring system study proposes assignment of a score based on the availability and duration of a "commercial guarantee" (warranty) for the entire (i.e. not only specific components) product offered by the guarantor, and including a "commitment to free repair as first remedy" in case of failures and a "commitment to upgrade the product periodically". The points are modulated proportionally between 0 points if fulfilling only the minimum legal requirements of 2 years and maximum 1 point for a commercial guarantee covering a period post-sale of at least 10 years.

Spare parts

Besides EU GPP, most of the analysed EU Ecolabel schemes have applied criteria for the availability of spare parts. EU GPP and Green Product Mark require duration of at least three years availability. Comprehensive EU GPP criteria, as well as Blue Angel even request that the availability of spare parts is guaranteed for at least 5 years, which specifically includes

rechargeable batteries if applicable. However, they differ with regard to the starting point: For EU GPP the time counts from the date of purchase, whereas for Blue Angel, it is following the end of production of the labelled product which might result in even more than five years after purchasing the product.

EPEAT, based on the IEEE standard, does not require a minimum time span for the availability of spare parts but manufacturers shall declare if spare parts are available at all and if so, the length of time the spare parts are available after the end of production, as well as a list of available spare parts. However, the time span is indirectly addressed in the optional IEEE criteria on 'product upgradeability and reparability', where it says that for these listed components 'the manufacturer, authorized service providers or other service providers offer upgrades, repair or replacement to purchasers for 5 years after the point of sale'.

There is also a difference in the definition of spare parts: whereas Green Product Mark does not specify spare parts at all, Blue Angel provides a rather general definition, delimitating them from 'other parts which normally exceed the life of the product' that are not to be considered as spare parts. EU GPP and TCO provide a specific list of components for different product types that fall under the criterion of spare parts availability.

Only EU GPP and Blue Angel address costs of spare parts. Whereas Blue Angel requirements state that spare parts must be offered at reasonable cost without defining this more specifically, EU GPP award criteria include the provision of a price list for a defined set of component parts including the requirement of indicative labour costs for replacements; points could be awarded then for the most cost-competitive offers.

For comparison, the reparability scoring system proposes as pass/fail requirement for reparability of laptops a minimum period of four years after placing the last unit of the model on the market, with a dedicated list of components. Also, the price of spare parts (however, not the repair labour costs) has to be disclosed. If spare parts availability is extended to seven years, a better rating class can be achieved.

Requirements on spare parts are included in the adopted EU Ecodesign regulation on displays which will apply from March 2021, with a minimum period of seven years after placing the last unit of the model on the market, specifying a dedicated list of spare parts. It can be expected that also the revised EU Ecodesign regulation on computers could include requirements on spare parts.

For the revision of the GPP criteria it is proposed to keep criteria on spare parts availability, at least as long as the mandatory Ecodesign requirements do not apply. If requirements on spare parts availability will still be included, the list of components might be extended and aligned to the draft revised EU Ecodesign regulation on displays as well as oriented towards either the key components of laptops identified by the JRC study on a reparability scoring system, or to the list of critical replaceable components of the TCO ecolabel. With regard to the requirements on cost competitiveness of spare parts, according to stakeholder feedback it seems to be very difficult to include the cost of the spare parts in the financial model or criteria besides for example costs of accessories (e.g. power cable, batteries); spare parts are often included in the maintenance services; manufacturers or IT service providers increasingly offer 'Device / Hardware / PC as a Service' models which include maintenance and repairs (if necessary) as well and thus dedicated costs of spare parts are not relevant, but rather the total cost of ownership. Against this background, also the provision of indicative labour costs for replacements seems to be debatable. It is thus proposed removing this award criterion.

Reparable / replaceable components

For the revision of the GPP criteria it is proposed to keep the criterion about design for reparability. Based on the comments received and the analyses of different other schemes, the list of parts to be easily accessible and replaceable, as well as the description of tools to be used, might be revised. For example, according to stakeholder feedback, the list of critical parts for displays is considered too strict as display panels are difficult to repair. It is proposed to apply the same list of parts proposed by TCO Certified for the different product groups.

EU GPP, EPEAT/IEEE and TCO, as well as the draft revised EU Ecodesign regulation on displays, the preparatory study for the revision of the EU Ecodesign regulation on computers and the study on a Reparability Scoring System all have criteria addressing the design for reparability in a sense that certain defined components have to be easily accessible, repairable and/or replaceable. For EPEAT/IEEE, this criterion is optional, i.e. optional points can be awarded depending on the number of hardware features out of the list that are upgradeable, repairable or replaceable (for example, for desktop computers minimum 7 features; for displays minimum 2 features to reach one additional point.

All the cited schemes specify the tools that may be used for the reparability, however in different ways:

- EU GPP requires that the components shall be easily accessible and replaceable 'by the use of universal tools (i.e. screwdriver, spatula, plier or tweezers)'.

- TCO requires in their 'products and sustainability information' criteria that information shall be provided if the replacement of the listed critical parts 'is possible without the use of heat or other tools than those intended to turn, slotted (ISO 2380), cross-recessed (Philips® and Pozidriv®, ISO 8764), or hexalobular recess heads (Torx®, ISO 10664).

- IEEE criteria require 'without soldering or de-soldering, using only commonly available tools', however not further defining these tools.

- The draft revised EU Ecodesign regulation for displays requires that 'the spare parts can be replaced with the use of commonly available tools and without permanent damage to the appliance'.

- The study on Reparability Scoring System provides comprehensive lists of tools for the repair of laptops, differentiating between basic and other commercially available tools. Below the list of basic tools for laptop[33]:

  o Basic tools: Screwdriver for slotted heads, cross recess or for hexalobular recess heads (ISO2380, ISO8764, ISO10664); Hexagon socket key (ISO2936); Combination wrench (ISO7738); Combination pliers (ISO5746); Half round nose pliers (ISO5745); Diagonal cutters (ISO5749); Multigrip pliers (multiple slip joint pliers) (ISO8976); Locking pliers; Combination pliers for wire stripping & terminal crimping; Prying lever; Tweezers; Hammer, steel head (ISO15601); Utility knife (cutter) with snap-off blades; Multimeter; Voltage tester; Soldering iron; Hot glue gun; Magnifying glass; Clean, soft, lint-free cloth; Magnifying glass; Quick grip clamps; Nonslip gloves; Painters tape; Isopropyl alcohol (IPA) wipe.

Additional basic tools have been selected based on the preliminary results of the study on material efficiency of smartphones[34] and are mainly applied for the repair of tablets and smartphones. It includes:

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[33] The applicability of this list is considered extendable also to desktop computers and computer displays.

[34] https://susproc.jrc.ec.europa.eu/E4C/documents.html

- Spudgers: tools that has a wide flat-head screwdriver-like end that extends as a wedge, used to separate pressure-fit plastic components without causing damage during separation.

- Different types of screwdrivers (e.g. Phillips, Flathead, Torx, Torx Security, Pentalobe)

- Plastic triangle opening tool: this type of tools are triangle in shape, with each corner offering prying abilities

- magnifier (or magnifying glass)

- suction cup

The analysed schemes also require information to facilitate repair activities:

- EU GPP: clear disassembly and repair instructions, e.g. hard or electronic copy, video; to be made available via hard copy or via the manufacturer's webpage.

- EPEAT: list of the hardware features that are upgradeable, repairable or replaceable and indicate, for each, whether it is upgradeable, repairable and/or replaceable.

- TCO: service manual including step by step instructions and component descriptions for the disassembly/assembly. Instructions on how to replace the critical components must be available online throughout the whole lifetime of the certificate.

- The draft EU Ecodesign regulation for displays has dedicated requirements related to the access to repair and maintenance information, however mainly targeted to professional repairers.

- The Reparability Scoring System for laptops proposes as pass/fail criteria that for each priority part, information about the disassembly sequence has to be available to the target group of repairers, where a description supported by illustrations of the steps needed to disassemble priority parts is needed. The description has to show that the disassembly is reversible by including the steps needed for the reassembly of priority parts.

Ensuring that batteries can be easily changed

Most of the analysed ecolabel schemes as well as the EU GPP criteria have dedicated requirements with regard to the replacement of the battery. All schemes require information, most of them instructions how to remove the battery from the product; for the required IEEE criteria, however, the manufacturer-provided instructions shall only guide customers to have

the battery replaced at a manufacturer-authorized service center whereas the optional IEEE criteria shall include the method of attachment to the product, a description how to remove the battery from the product as well as a list of the tools required for removal and, if they are not commonly available, how to obtain them.

Only EU GPP criteria prescribe that batteries shall not be glued or soldered into the products. Also, the comprehensive EU GPP criteria provide most details with regard to the number and kind of tools to be used for replacement. TCO only requires information if the battery can be replaced without tools. EPEAT/IEEE optional criteria require replacement either without tools or with commonly available tools, and without the use of external heat sources. Further, EPEAT/IEEE optional criteria prescribe the maximum time (three minutes) allowed for the battery replacement by one person.

None of the schemes explicitly requires that the battery shall be replaceable by the end-user; only Blue Angel says that replacement shall be able without the need of expert knowledge. TCO criteria on battery replacement are oriented towards both end-user and/or technician.

Green Product Mark criteria are aligned to the required EPEAT/IEEE criteria 'battery replacement and information'. Only the verification method slightly differs. Green Product Mark differentiates between batteries being user-replaceable, where for example the disassembly steps might demonstrate that the batteries are replaceable; and batteries that are not user replaceable, where manufacturer-provided instructions shall be given guiding consumers to have the battery replaced at a manufacturer-authorized service centre.

EU GPP current criteria are strict with regard to prohibiting the gluing or soldering of batteries into portable products at all; however, with feedback from some stakeholders of being too restrictive as many products using adhesive can still be replaced by a certified technician. Blue Angel and TCO Certiefied go beyond GPP criteria by addressing also end-users as potential target group for battery replacements. On the other hand, procurement authorities often have contracts with IT service providers so that the battery replacement is under the responsibility of the tenderer, service provider and/or manufacturers.

TCO Certified criteria related to instructions on how to replace the battery are most detailed and ambitious as they must be available for anyone to read, free of charge, online through the whole lifetime of the certificate.

For this revision of the proposed criteria this aspect is considered to be covered under the "Design for reparability" criterion for critical components.

Secure data deletion

Data deletion aims to facilitate both the reparability/reusability of the whole products without the risk of transfer of any sensitive and personal data in reused equipment. As defined in the Ecodesign Commission Regulation (EU) 2019/424 the 'secure data deletion' means the effective erasure of all traces of existing data from a data storage device, overwriting the data completely in such a way that access to the original data, or parts of them, becomes infeasible for a given level of effort.

Different methods used for data deletion are appropriate for different types of memories. Data deletion of HHD and SSD is declared by some manufacturers (e.g. HP Secure Erase) (HP 2018) to be compliant with specific standards (e.g. Guidelines for Media Sanitization by NIST (2014)). Secure data deletion tools should built-in (or as second option made available on request) and should permanently delete all user data without compromising the functionality of the device for further use. According to the CEN-CENELEC draft standard on reparability of energy related product (prEN 45554), simplified transfer of data from an old to a new product should also be made available via installed or downloadable tools such as applications, cloud-based services or instructions detailing a manual process.

Minimum capacity

EU GPP award criteria as well as several ecolabel schemes have rather different criteria on upgradeability, capacity expansion or standardised interfaces. The comprehensive award criteria of the current EU GPP foresee certain requirements for the RAM memory (minimum capacity or the potential to upgrade it) as well as the potential to upgrade the mass storage. However, according to stakeholder feedback, the criterion on minimum RAM memory capacity restricts the market, and that some Operating Systems require less RAM (only 2 to 4 GB).

For the revision of the GPP criteria, it is proposed to remove that criterion. The potential to replace and upgrade the RAM is already covered by the requirements on design for reparability (TS9b).

2.1.1.2 Initial background and rationale for the proposed verification

Provision of an extended manufacturer guarantee and service agreement

At the tendering stage a written declaration from the tenderer that the products supplied will be warrantied in conformity with the contract specifications and the related service level

agreement could be sufficient. However, the implementation of this criterion should be ensured by contract performance conditions aiming to the monitoring and achievement of specific KPIs.

Spare parts

Also in this case, at the tender stage a declaration that critical components will be available is deemed to be sufficient. As the tenderer is in many cases an IT service provider (and not the manufacturers of IT equipment) it should be considered to ensure these aspects through the use of labelled products covering requirements on the availability of spare parts.

Reparable / replaceable components

The verification should be based on the provision of product's manuals / instructions showing on how to replace the parts. In order to ensure that the repair / replacement can be carried by an independent repairer (e.g. the ICT team in the organization or a third-party service provider) a service manual should be public available. A direct link to the document on the manufacturer's website should be used to proof that repair instruction are public available.

Also in this case, as the tenderer is in many cases is an IT service provider (and not the manufacturers of IT equipment), the compliance could be ensured through the use of labelled products (e.g. TCO Certified, generation 8).

Data deletion

It is requested to provide information about the software for the data deletion. Relevant reference is the NIST 800-88 Revision 1 guidelines.

2.1.1.3   Summary of stakeholder answers from the initial survey

Warranty and service agreements

It was highlighted that the mandatory manufacturer guarantee under B2B is 6 months. Some public procurers reported to have applied 36 months warranty as requirement and that suppliers currently provide 3 years of warranty in the Nordic countries. According to some respondent the three year warranty is considered very challenging and not covered by the 30-50 % of the market. 2 years is instead considered reasonable in the EU context. It was remarked by some respondent that the mandatory warranty has to explicitly cover battery. Another stakeholder suggested including helpdesk support that would also include software.

Maintenance services are reported to be requested for additional duration of 2, 3 or 4 years including repair and pick-up. It is also requested to include clarification on what exactly a service should include. Moreover, it is also highlighted that service agreements and warranty could be offered by third party and not be dependent on manufacturers.

According to a stakeholder, extending warranty is considered as something that can be asked to offer (technical specification) and not to be used as award criteria. On the other side, changing to a third party for warranty/service after 2/3 years is also considered a valid option. Many SME's will be able to fulfil this, while they probably cannot respond to the initial tender.

Continued availability of spare parts

This criterion is reported to be applied in public tenders and fulfilled by written guarantee. Most of the time the tenderer do not correspond with the manufacturer, as the contract is carried out by an IT service provider. In this case the tenderer is not the organisation in charge of managing the availability of spare parts and it is suggested to ensure these aspects through the use of labelled products. The three years period is deemed reasonable by several respondents however more ambitious examples are reported in Finland (5 years).

Design for reparability

Also this criterion has been applied. TCO Generation 8 label is reported as possible verification method, ensuring a free available manual. The list of critical components for displays is considered too strict as display panels are difficult to repair.

It was also highlighted some trade-offs with warranties and service agreements. Manufacturers do not allow a non-technical person to assemble any laptop or device. The repairs should be handled only by certified repair centres (during the warranty period) to avoid voiding manufacturer warranty.

Ease of replacement for rechargeable batteries

Also in this case, some stakeholders suggested better separating the responsibility of tenderer, service providers and manufacturers. Some stakeholders commented that this was impossible to adopt as many products have the battery soldered and only to be replaced by a authorised technician. Others have reported to have applied this criterion with success.

In some cases, tenderers asked for additional batteries but without a repair service or user instruction. It is recommended that instructions are requested or additional services for repairs and replacement. Some respondents considered this requirement not relevant as disqualifying some products with already high durable batteries included.

Cost competitiveness of spare parts

It was found is very difficult to include the cost of the spare parts in the financial model / criteria. Costs of accessories (e.g. power cable, batteries) are included in some tenders. It has to be considered that in some procurement routes the purchasing entities do not repair the devices themselves / buy spare parts but purchase maintenance services. Spare parts are included in the maintenance services and thus their cost is not relevant. Some manufacturers suggested to remove this criterion as often large companies provide PCs as a Service (PCaaS) solutions that offer PC lifecycle services including deployment, security, support and asset recovery. Total cost of ownership in this case needs to be considered.

Tablet and all in one notebook memory and storage

Respondents consider that this criterion restrict the market. It is also commented that some Operating System require less RAM (2-4 GB).

2.1.1.4 Further background after AHWG meeting and first stakeholder consultation

TS6(a) Provision of and extended service agreement and TS6(b) Manufacturer's warranty

The stakeholders provided different opinions on the length of warranty. Some stakeholders suggest longer periods, with a minimum warranty aligned with the B2C market. Others consider that shorter periods should be applied in the B2B context. Moreover, some stakeholders requested that aspects related to software renewal should be better integrated in the service agreement and that priority of repair strategy should be stronger supported.

In this new revision TS6(a) has been modified as follow:

- It is kept as 2 years as minimum duration of a service agreement (core level). The length of the service agreement is kept open. The intention is to indicate that the service agreement duration should be tailored on the needs of the tenderers (e.g. procurers' needs, technological choices, budget availability).

- It is clarified that preventive maintenance during the warranty period should include ensuring OS and security updates for the duration of the contract.

- It is also proposed to add in the explanatory note on possible services agreement a periodical scan for upgrading possibilities.

TS6(b) Manufacturer's warranty

Regarding the TS6(b) on Manufacturer's warranty the same approach (2 years as core / longer period to be defined) of TS6(a) is proposed. In principle, if a service for the maintenance and repair of the product is included in the tender according to TS6(a), it is not necessary to request also the manufacturer warranty according to TS6(b), as the maintenance and repair of the product is already ensured by the tenderer. However, the two criteria are not considered mutually exclusive.

TS7(a) Continued availability of spare parts

Some manufacturers suggested to refer to the end of production date for the criterion TS7(a), however this is rejected as the date of purchase must be considered as reference. This aspect is something to be regulated in a different policy tool (i.e. Ecodesign implementing measures). Moreover we consider that is up to the public administration to decide about the length of spare part availability based on their needs: in case the replacement policy for computers is 5 years, it would be probably appropriate to ask for availability of spare parts for 4 to 5 years. Moreover it will be up to the tenderer (that can be different from the manufacturer) the responsibility to ensure the spare part availability.

TS7(b) Design for reparability

Some manufacturers suggested to exclude soldered CPU from the list of critical components. Moreover, it was requested to include additional components as ports and connectors that are reported as a common failure point for tablets. It was suggested an alternative wording for this criterion, that is considered applicable for a core criteria. As suggested from some stakeholders a note is now added on the exclusion of soldered CPU from the list of critical components. Based on the different views expressed by the stakeholders the criterion was split between a core (not referring to any specific list of tools) and comprehensive (referring to basic tools as defined by the EN45554:2020).

TS8. Refurbished products

Deleted here and included as "Criteria area 5 – Criteria proposals for refurbished / remanufactured products", cf. section 2.5

TS9. Functionality for secure data deletion

This criterion on functionalities for secure data deletion is fully supported and it proposed to be included as core criterion.

2.1.2   Criterion 1.2 – Rechargeable battery life and endurance

In addition to the endurance requirements for batteries, it has been proposed an information criterion on the correct management of the battery and measurement of state of health, and new software related criteria aiming to ensure a correct management of the batteries. A wider Technical Specification on minimum requirements in terms of electrical performance of the battery has also been proposed.

The following table compares the existing GPP criteria with the new proposals.

Table 4:   Rechargeable battery life and endurance current criteria (2016) and TR v2.0

GPP 2016	TR v2.0 Proposal
	TS10. Rechargeable battery endurance
	New! TS11. Minimum requirements on the electrical performance
	New! TS12. Information on battery state of health
	New! TS13. Battery protection software
AC5. Rechargeable battery life and endurance	AC5. Further rechargeable battery endurance

Summary of the main changes after the first stakeholder consultation

The main focus of this revision is to find the most appropriate solution for the selection of a threshold for the TS10. Clarifications on definitions and applicability of the standard are also provided as on the use of eco-labels as proof of compliance. A more clear distinction between the core and comprehensive level for TS13 is also proposed.

The following table shows the criteria as revised after the AHWG meeting and the first stakeholder consultation.

Second criteria proposal	
Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
TS10. Rechargeable battery endurance *Applicable to mobile devices (notebooks / tablets and smartphones)* The State of Health of the battery after 300 cycle must be equal or higher than (≥80%). Tests must be carried out according to the standard IEC EN 61960-	**TS10. Rechargeable battery endurance** *Applicable to mobile devices (notebooks / tablets and smartphones)* The State of Health of the battery must be

3:2017. See the explanatory note below for the definitions..	• equal of higher than ((≥90%) after 300 cycles, or
Verification:	• Equal or higher than (≥80%), after 500 cycles
Tenderers must provide test results obtained by accredited ISO17025 test bodies according to the IEC EN 61960-3:2017 standard.	Tests must be carried out according to the standard IEC EN 61960-3:2017.
Products holding a relevant Type I Eco-label fulfilling this specified requirement will be deemed to comply. In particular holding one the following labels is considered as proof of compliance:	**Verification**:
	Tenderers must provide test results obtained by accredited ISO17025 test bodies according to the IEC EN 61960-3:2017 standard.
• Blue Angel for Computers and Keyboards (DE-UZ 78 (2017))	Products holding a relevant Type I Eco-label fulfilling this specified requirement will be deemed to comply. In particular holding one the following labels is considered as proof of compliance:
• TCO Certified Generation 8 certificate (if the certificate shows compliance with 80% capacity retention)	• Blue Angel for Computers and Keyboards (DE-UZ 78 (2017))
• Nordic Ecolabelling Version 5.0 for rechargeable batteries and portable chargers (2018)	• TCO Certified Generation 8 certificate (if the certificate shows compliance with 80% capacity retention)

EXPLANATORY NOTE: Definition of State of Health (SoH)

State oh Health (SoH): Current full charge capacity (in mAh) expressed as percentage of the design capacity (rated capacity).

	New! TS11. Minimum requirements on the electrical performance
	Applicable to mobile devices (notebooks / tablets and smartphones)
	The battery must be compliant with the electrical test acceptance criteria according to standard IEC EN 61960-3:2017 (see details in the Annex I of this document).
	Verification:
	Tenderers must provide test results obtained by accredited ISO17025 test bodies according to the EC EN 61960-3:2017.

New! TS12. Information on battery state of health

Applicable to mobile devices (notebooks / tablets and smartphones)

The tenderer must provide the equipment with a pre-installed software to determine and monitor the Battery/Accumulator status and allowing the reading of the battery's/accumulator's "state of health", and "state of charge", as well as the number of "full charge cycles" already performed from the battery/accumulator and to display these data for the user. See the explanatory note below for the definitions.

The software must also provide tips for users to maximise battery lifespan.

Verification:

The tenderer must provide the specifications and version the software.

Equipment holding the following Type I Eco-labels will be deemed to comply. In particular holding the following label is considered as proof of compliance:

- Blue Angel for Computers and Keyboards (DE-UZ 78 (2017))

EXPLANATORY NOTE: Definition of charge cycle, State of Charge (SoC) and State of Health (SoH)

- Charge Cycle: One charge cycle is completed when the battery is fully charged from 0% up to 100% and then discharged back down to 0%., This could be performed by partially charging-discharging the battery multiple times on different State of Charge (SoC) levels as long as the total amount of charge-discharge percentage is approximately equal to the nominal capacity.

- State of Charge (SoC): The remaining battery capacity expressed as a percentage of full-charge capacity (SBS-IF, 1998).

- State oh Health (SoH): Current full charge capacity (in mAh) expressed as percentage of the design capacity (rated capacity).

New! TS13. Battery protection software	**New! TS13. Battery protection software**
Applicable to notebooks	*Applicable to tablets and smartphones.*
The tenderer must provide the equipment with a pre-installed software (as default setting) to enable a limit on the battery state of charge (SoC) when the computer is used systematically in grid operation to a value equal/smaller than ≤80% SoC.	The tenderer must provide the equipment with a battery management system that includes an intelligent charging software able to identify the user's regular charging habits / pattern, stopping the charging process before it reaches 100% (e.g. at 80%), and fully charging the device only when needed by the user.
Verification:	**Verification**:
The tenderer must provide the specifications and version the software.	The tenderer must provide the specifications and version the software.
Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.. In particular holding one the following labels is considered as proof of compliance:	Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.
- Blue Angel for Computers and Keyboards (DE-UZ 78 (2017))	

AWARD CRITERIA	
	AC5. Further rechargeable battery endurance
	Applicable to mobile equipment (laptops / tablets and smartphones)
	Additional points will be awarded If the battery endurance is granter than 500 cycles (with ≥80% capacity retention of the initial rated capacity) proportionally to the additional number of cycles ensured.
	Verification:

	Tests must be carried out according to the standard IEC EN 61960-3:2017 at 20 ± 5oC and at a rate of 0.5 It A (accelerated test procedure) Tenderers must provide test results obtained by accredited ISO17025 test bodies.

2.1.2.1   Initial background and rationale for the proposed criteria

Battery life endurance

One important reason why mobile ICT products are discarded or replaced is the short life of main batteries installed in portable ICT products. Even when the batteries are replaced and the entire products are not discarded, this could generate environmental impacts related to the end of life management of worn-out batteries and additional operational costs for the public administration. For this reason, the endurance requirement for battery is kept.

Different criteria on capacity retentions and number of cycles are applied so far in various ecolabel schemes and this revision can be an opportunity to harmonize the EU GPP approach with these labels, also to allow using the existing ecolabel certification as verification method.

Relevant parameters used to define the battery life endurance are:

- State of Charge (SoC): Currently available capacity (in mAh) expressed as percentage of the capacity at full charge (full charge capacity)

- State oh Health (SoH): Current full charge capacity (in mAh) expressed as percentage of the design capacity (rated capacity).

In some cases, State of Charge is also used to indicate State of Health, however State of Health (SoH) is considered the most appropriate term,

About the applicable thresholds, 300 cycles at 80% SoH can be considered as a possible minimum requirement for mobile IT equipment. However, data collected by TCO Certified suggest that most of the products certified have batteries ensuring a SoH higher than 80% after 300 cycles[35]. Even though 300 cycles do not reflect the expected longevity of the battery, it could be still a practical way to exclude the worst performing products from the tenders, without increasing verification costs for manufacturers.

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[35]Based on anonymized statistics provided by TCO (mid-2019).

For the comprehensive criteria the following option for the threshold was proposed in the first draft revsion:

- 500 cycles (with ≥80% SoC) respectively (as for the current GPP criteria)

Moreover, some notebooks and tablets listed in the EPEAT database fulfil an optional criteria based on the capacity retention (≥65% SoC) after 1000 cycles. Some manufacturers (e.g. Apple) claim for its notebooks and tablets battery capacity at 1000 complete charge/discharge cycles. However the EPEAT criterion does not request that tests on battery endurance are carried out by ISO 17025 accredited laboratories. This is instead requested under ecolabels as Blue Angel, Nordic Ecolabelling and TCO Certified.

The main technical reference for lithium battery endurance is the standard IEC EN 61960:3-2017. This standard requires testing the battery at a specific current rate 0.2 It A[36] for the number of cycles until a capacity retention > 60% is reached or, as accelerated test option, testing at 0.5 It[37] A the capacity retention at 300 cycles. However, in terms of charging profile this test method allow more flexibility. In terms of performance this standard covers also other electrical tests of batteries/cells including its rated capacity, performance at low temperature and fast discharge rate, capacity retention after storage and the effect of electrostatic discharges. These tests are able to capture other relevant performance aspects of the battery and the different degradation mechanisms, compared to the simple charging / discharging cycles of the endurance tests.

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[36] It basically means that the battery is tested with a discharging cycle of around 5 hours.

[37] It correspond to an accelerated test condition where the discharging cycle take place in 2 hours.

Table 5: **Electrical tests and acceptance criteria covered by the IEC EN 61960:3-2017**

Parameter	Description	Acceptance Criteria Battery
Discharge performance at 20 °C (Rated Capacity)	This test verifies the rated capacity of the battery.	100% of the rated capacity (C5 Ah)[38]
Discharge performance at −20 °C (Rated Capacity)	This test determines the capacity of the battery at low temperatures	30% of the rated capacity (C5 Ah)
High rate discharge performance at 20 C	This test determines the capacity of the battery when discharged at high rate. This test is not required if the battery is not designed to be used at this rate (1 ItA)	60% of the rated capacity (C5 Ah)
Charge (capacity) retention and recovery	This test determines firstly the capacity which a battery retain after a storage for an extended period of time (28 days) and secondly the capacity that can be recovered by a subsequent recharge.	60% of the rated capacity (C5 Ah)
Charge (capacity) retention after long term storage	This test determines the capacity of a battery after extended storage (90 days) at 50% state of charge, followed by a subsequent charge	85% of the rated capacity (C5 Ah)
Endurance in cycles	This test determines the number of charge/discharge cycles which a battery can endure before its capacity has been significantly depleted.	60% of the rated capacity (C5 Ah) after 300 cycles
Electrostatic discharge	This test is to evaluate the ability of a battery to with stand electrostatic discharge.	Operational

Information on Battery state of health

In support to the endurance requirement for batteries, it is proposed to include software related requirement. This would facilitate a correct monitoring and implementation of the replacement policy for the mobile equipment fleet of a public administration.

Blue Angel requires the existence of software determining the battery/accumulator status and allowing the reading of the battery's/accumulator's "state of health", "state of charge", as well as the number of full charge cycles already performed from the battery/accumulator and to display these data for the user.

User behaviour is also an important factor in prolonging the battery lifespan. Factors that can be controlled by the final users include:

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[38] Amount of electricity declared by the manufacturer that a cell can deliver in a 5 hours period

- ensuring the computer is well ventilated and doesn't overheat,

- power management settings are used when unplugged and that partial charging systems are used where available

- correct storage of the battery during long periods of disuse

It is considered important that the tenderer provides guidance to users on how to maximise battery life. The provision of this information on battery health can drive user behaviour toward prolonging battery life and can be also relevant in case of reuse of the devise.

Battery protection software

The wear-out of batteries can be limited by the use of specific protection software. The so-called 'intelligent charging' was already identified by stakeholders as an important feature in the previous revision.

The preparatory study on the revision of the EU Ecodesign regulation for computers proposes criteria with regard to a 'Battery optimization built-in functionality': Manufacturers shall provide pre-installed software to enable a limit on the battery state of charge (SoC) when the computer is used systematically in grid operation. Such functionality shall prevent the battery to be loaded at full charge. The manufacturer shall inform the user of the existence and the benefits of using such functionality.

Further, as included in Blue Angel Criteria, a required Battery/Accumulator Protection Software shall be able to limit the battery's/accumulator's charge to a value smaller than the maximum amount of usable electricity (e.g. 80% of full charge capacity) to extend the battery's life.

In the case of smartphone and tables the overnight charging duration is often unnecessarily long, the battery is subjected to a high average state of charge (SOC), which accelerates battery aging. Therefore, intelligent charging systems (also called smart charging) over the duration of the night can provide a protection against aging[39,40,41].

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[39] http://emareg.de/publication/smart2_charger/

[40]https://support.apple.com/en-us/HT210512

[41] https://www.huaweicentral.com/smart-charging-mode-emui-feature-march-2020/

2.1.2.2   Initial background for the proposed verification

All schemes refer to standard IEC 61960 or related EN 61960 / DIN EN 61960 standards respectively. IEC 61960-3:2017 specifies performance tests, designations, markings, dimensions and other requirements for secondary lithium single cells and batteries for portable applications.

2.1.2.3   Summary of stakeholder answers from the initial survey

This criterion is adopted and adapted in tenders according to the respondents. Different thresholds are reported to be applied by different labels. Simplification of the testing and verification procedure is also suggested.

2.1.2.4   Further background after AHWG meeting and first stakeholder consultation

TS10 Rechargeable battery endurance

Comments received are mainly related to the threshold selection in terms of number of cycles with some stakeholders suggesting to increase the threshold to 500 or more cycles and other stakeholder considering that 300 cycle testing representing the only available reliable data provided by batteries manufacturers. The proposal of this revision is to keep asking for the 300 cycles testing according to the EN 61960 as this test represents a standardised reference and widely applied by industry. The battery must ensure 80% SoH after 300 cycles as core criterion. For the comprehensive criterion is proposed, as alternative to more than 500 cycles with 80% SoH, a threshold of 90% SoH after 300 cycles.   Some clarifications on definitions and applicability of the standard are also provided. In particular definition of State of Charge or State of Health have been improved / corrected and added in an explanatory note.

It was also commented that IEC 61960 does not allow for charging that emulates the charging profile of the product. However JRC considers that this is already allowed by the IEC standard: according to the IEC 61960-3: 207 (Section 7.2), cells shall be charged, in ambient temperature of 20±5 °C, using the method declared by the manufacturer.

It was questioned also the reference to ISO 17025 accredited test bodies. It is also commented that requiring certified test bodies adds lead time and cost, without real environmental gain. JRC considers that the involvement of accredited test bodies is beneficial in terms of quality assurance of the test results and the procurement process can benefit from it.

TS11. Minimum requirements on the electrical performance

Regarding this criterion it was requested to clarify which tests and thresholds are associated. The list of test is added in Annex 3 to this document.

TS12 Information of battery state of health

According to a manufacturer, the total number of cycle counts is not a relevant information for the user. As the battery lifespan in terms of total cycles is depending on the battery type and appliance, the pure number of cycle counts reached does not provide useful information towards the remaining lifetime of the battery neither the capacity hold left. The state of health and state of charge provide better information. JRC does not agree as this information on number of cycles allows procurers monitoring the degradation trends and mechanism of batteries used for the ICT fleet.

TS13. Battery protection software

It is unclear how the "core criteria" is different from the "comprehensive criteria" in the case. Both require pre-installed software that enables the user to prevent the battery to be fully charged. In this second proposal is clarified the criteria is basically the same. The two levels, core and comprehensive, aim to highlight the difference in terms of relevance of the applicability of this criterion to different product groups. The criterion is considered core for notebooks expected to be used as workstations and comprehensive for the other mobile ICT products not intended to be used plugged in the grid Reference to intelligent charging systems software able to identify use patterns is also suggested. Intelligent charging software that identifies the user's regular charging behaviour could allow to exceed 80% charge capacity in specific moment of the day/week.

2.1.3   Criterion 1.3 – Mobile equipment durability testing

The scope of the criteria is to expand the scope of the criteria included in the EU GPP Criteria (2016) to all the categories of mobile equipment, including laptops, tablets and smartphones. A core technical specification aims to ensure that the product is able to withstand drops. Comprehensive criteria are proposed to cover a broader spectrum of stresses. A new criterion on ingress protection from dust and water is proposed to be included, with a special focus on equipment used for outdoor working activities or other harsh usage environments and

conditions. The criterion on durability tests for SSD has been removed as this aspect is considered to be covered by the durability testing of the entire device.

The following table compares the existing GPP criteria with the new proposals.

Table 6: **Mobile equipment durability testing current criteria (2016) and TR v2.0**

GPP 2016	TR v2.0 Proposal
	New! TS14 Drop testing
	New! TS15: Temperature Stress
	New! TS16 Ingress protection level
AC7. Notebook computer drives	AC6: Mobile equipment durability testing
AC8. Notebook durability testing	New! AC7: Ingress Protection Level – Semi Rugged and Rugged Devices

Summary of the main changes after the first stakeholder consultation

Minor changes as adding the reference to alternative test procedure and to the ecolabels that can be used to demonstrate compliance.

The following table shows the criteria as revised after the AHWG meeting and the first stakeholder consultation.

Second criteria proposal	
Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	

New! TS14 Drop testing	
(same for core and comprehensive criteria)	
Applicable to mobile devices (notebooks, tablets and smartphones)	
The equipment must be tested according to the following standards:	
• IEC 60068 Part 2-31: Ec (Freefall, procedure 1), or	
• MIL-STD-810G w/CHANGE 1 Drop test: Method 516.7 - Shock (procedure IV)	
with a drop height of 45 cm. Functional performance requirements in Annex II of this document must be met by the equipment after the exposure to the drop test.	
Alternatively the device must be provided with of cover and protection cases tested for or designed according to robustness standard such as US MIL-STD-810G or equivalent test procedures.	
Verification:	
The tenderer must provide test reports showing that the model has been tested and has met the functional performance requirements for durability.	
Testing must be carried out by a test facility accredited according to ISO 17025.	
Existing tests for the product, carried out to the same or a stricter specification, will be accepted without the need to retest.	
Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply. In particular TCO Certifed, Generation 8 is considered as a valid proof of compliance.	

	New! TS15: Temperature Stress
	Applicable to mobile devices (notebooks, tablets and smartphones)
	The equipment must be tested according to the following standards:
	• IEC 60068 Part 2-1: A Cold Part 2-2: B Dry Heat, or
	• MIL-STD-810G w/CHANGE 1 High temperature: Method 501.6 - Basic Hot (A2) and Low temperature:Method 502.6 - Basic Cold (C1)
	with the modified storage / operational temperatures described in Annex II.
	Functional performance requirements in Annex IV of the criteria document must be met by the equipment after the exposure to the temperature stress tests.
	Verification:
	The tenderer must provide test reports showing that the model has been tested and has met the functional performance requirements for temperature stress.
	Testing must be carried out by a test facility accredited according to ISO 17025.
	Existing tests for the product, carried out to the same or a stricter specification, will be accepted without the need to retest.
	Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply. In particular TCO Certifed, Generation 8 is considered as a valid proof of compliance

	New! TS16 Ingress protection level
	Applicable to mobile devices (notebooks, tablets and smartphones)
	The equipment delivered as part of the contract must have passed durability tests carried out according to:
	• IEC/EN 60529:2013, Degrees of Protection Provided by Enclosures (IP Code)
	• Or MIL STD-810G Method 510.5, Procedure I sand and dust - Blowing dust and MIL-STD-810G, Method 506.5 (Procedure I Rain and blowing rain)
	The degree of protection provided by enclosures must be classified as level IP54 or higher.
	Verification:
	The tenderer must provide test reports showing that the model has been tested and has met the functional performance requirements for ingress protection level.
	Testing must be carried out by a test facility accredited according to ISO 17025.
	Existing tests for the product, carried out to the same or a stricter specification, will be accepted without the need to retest.
	Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.

EXPLANATORY NOTE: Degree of protections as for the IEC/EN 60529:2013

- Degree of protection against solid foreign objects indicated by the first characteristic numeral

  - IP5x - Ingress of dust is not totally prevented, but dust must not penetrate in a quantity to interfere with a satisfactory operation of the apparatus or to impair safety

  - IP6x - No ingress of dust; complete protection against contact;

- Degree of protection against water indicated by the second characteristic numeral

  - IPx4 - Water splashed against the enclosure from any directions must have no harmful effects.

  - IPx5 - Water is projected in jets against the enclosure from any direction with no harmful effects;

  - IPx6 - Water is projected in powerful jets against the enclosure from any direction with no harmful effects;

  - IPx7 - Ingress of water in quantities causing harmful effects must not be possible when the enclosure is temporarily immersed in water under standardized conditions of pressure and time

  - IPx8 - Ingress of water in quantities causing harmful effects must not be possible when the enclosure is continuously immersed in water under conditions which must be agreed between the manufacturer and user but which are more severe than for numeral 7.

AWARD CRITERIA

AC6: Mobile equipment durability testing

(same for core and comprehensive criteria)

Applicable to mobile devices (notebooks, tablets and smartphones)

The tests applicable must be specified in the tender in order to reflect the conditions of use defined for the product.

Points will be awarded for offers including products that have passed durability tests carried out according to IEC 60068, US MIL810G or equivalent.

A maximum of x points [to be specified] may be awarded:

- Accidental drop (x points)*
- Resistance to shock (x points)
- Resistance to vibration (x points)
- Screen resilience (x points)
- Temperature stress (x points)*

Functional performance requirements and test specifications are provided in Annex II of the criteria document.

Verification:

The tenderer must provide test reports showing that the model has been tested and has met the functional performance requirements for durability.

Testing must be carried out by a test facility accredited according to ISO 17025.

Existing tests for the product, carried out to the same or a stricter specification, will be accepted without the need to retest.

Equipment holding the relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.

New! AC7: Ingress Protection Level – Semi Rugged and Rugged Devices

Applicable to mobile devices (notebooks, tablets and smartphones)

To be include in case the expected use is for outdoor working activities or other harsh usage environments and conditions.

Points will be awarded in case the offered products demonstrate to have reached the following IP Protection Level according to the IEC/EN 60529:2013

- IP65 – 025 X points
- IP66 – 0.5 X points
- IP67 – 0.75 X points
- IP68 – X points

Verification:

The tenderer must provide test reports showing that the model has been tested and has met the functional performance requirements for ingress protection level.

Testing must be carried out by a test facility accredited according to ISO 17025.

Existing tests for the product, carried out to the same or a stricter specification, will be accepted without the need to retest.

Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.

2.1.3.1   Initial background and rationale for the proposed criteria

Options to improve the durability performance of laptops and other mobile equipment may be related to the procurement of products that ensure a resistance to drops and other physical stresses as water contact, dust and extreme temperatures.

According to an IDC study (2016)[42] among 800 United States organisations the mobile equipment failure rate is in general very high: for notebooks it is 18 % (average of company notebooks requiring repair of some kind, during a year). The rate of failure increases each year a device is in use, ranging from 11 % failing the first year to more than 20 % failing by year five. According to this study, among the top ways end-users damage devices, the overwhelming top reason across categories was simply dropping the device while carrying it or falling from the desk. Other relevant reasons are water/dust ingress, temperature stress, vibration and power shock.
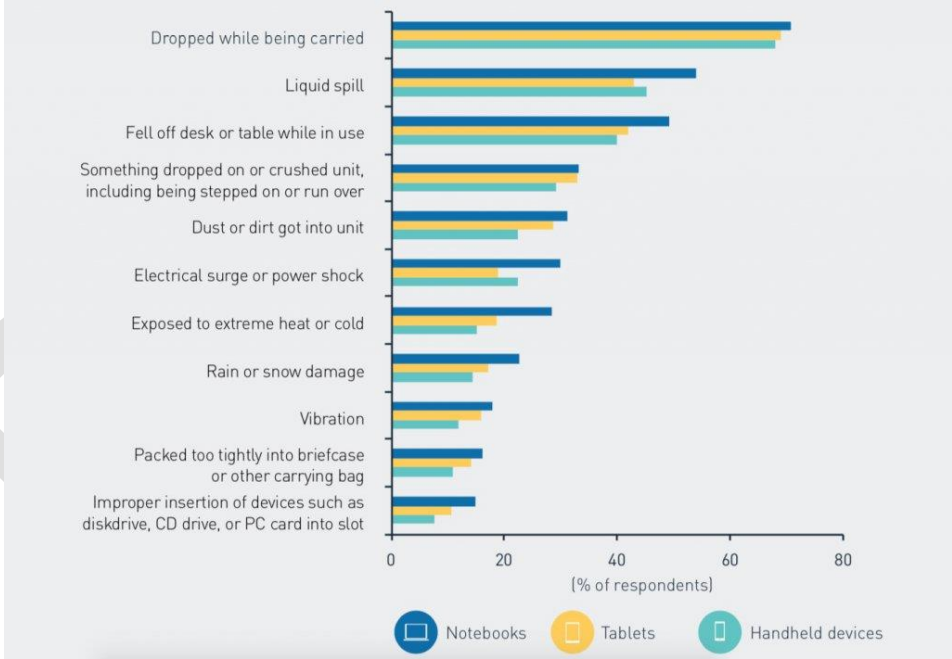
Figure 11: **Damages for mobile equipment in organizations reported by the IDC study (2016)**

Risks of physical stress for the equipment are also linked to the work environment, with higher levels of stress expected for products used in outdoor environment.

Drop and temperature stress tests

Only the current EU GPP award criteria (comprehensive) and TCO Certified include requirements on durability tests for notebooks and tablets, both referring to test procedures as specified in the US MIL-STD-810G or IEC 60068.

TCO Certified, Generation 8 requires a drop test as well as a temperature stress test (high and low temperature) for mobile ICT devices as notebooks, smartphones and tablets; in addition to a drop and temperature stress test, the current EU GPP criteria for Computers and Monitors (2016) further entail resistance to shock and vibration as well as screen resilience. Additionally, EU GPP has dedicated durability criteria for computer drives.

The detailed conditions of the drop and temperature tests slightly differ with stricter requirements for EU GPP; see Table 7.

Test conditions for temperature test: according to EU GPP, the notebook shall be subjected to a minimum of four 24-hour exposure cycles in a test chamber. TCO test cycles are ≥ 48h for storage and ≥ 4h for operational temperature.

Table 7: **Differences in test conditions of durability tests between EU GPP and TCO**

	High temperatura	Low temperature	Drop test
EU GPP (2016)	The notebook shall be operational during a dry heat cycle at +40°C. The notebook shall be non-operational a dry heat cycling between +35°C and +60°C.	The notebook shall be operational during a cold cycle at -25°C. The notebook shall be non-operational during a cold cycle at -50°C	≥ 76 cm drop height onto a non-yielding surface. A minimum of one drop shall be made on each bottom side and each bottom corner.
TCO	Operational temperature for ≥ 4h: ≥ +40°C Storage temperature for ≥ 48h: ≥ +60°C;	Operational temperature for ≥ 4h: ≤ -20°C Storage temperature for ≥ 48h: ≤ -30°C;	≥ 45 cm drop height

According to stakeholder feedback the approach of the durability testing is generally supported. TCO Certified version 8 has set the drop test limit to 45cm after discussions with the industry. TCO reports that, even at this level, there are premium products not being able to pass this criterion and therefore fail to certify accordingly to TCO Certified, generation 8.

Further, the analysis of voluntary approaches of front-running companies revealed that only few companies seem to apply US MIL-STD-810G or IEC 60068 as regular product durability tests, either to appliances for professional use (see example of HP, LG[43], Lenovo[44]), or especially for so called 'rugged' appliances (see examples of Dell[45] and Zebra Technologies [46]). For the revision of the GPP criteria, it is proposed to harmonise test methods and thresholds introducing the TCO Certified conditions for temperature and drop tests as thresholds for the core criteria, whereas the more ambitious GPP criteria are proposed to be kept as award criteria. In this revision it is also better specified how to determine if a product passes or fails the test.

Ingress protection

This proposed criterion focuses on the resistance to water and dust ingress.

Liquid spillage on detached keyboard (of desktops) results in relatively inexpensive replacements. In notebook/laptops the liquids penetrate and damage internal expensive parts, including the mother board and storage controllers: the repair is so expensive that generally the computer is disposed of[47].

Waterproof solutions for computers are possible, with increasing rates of protection of internal components. As a minimum, sealing can be implemented, so that just the relatively cheap notebook keyboard is replaced. Standard IEC 60529 classifies and rates the degree of Ingress Protection (IP) provided against, dust, water, accidental contact, and intrusion through mechanical casings and electrical enclosures. The IP code consists of two digits, indicating the solid particle protection class and the liquid ingress protection class.

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[43] https://www.lg.com/sg/laptops/lg-14Z980-GAA5CA3

[44] https://www.lenovo.com/ww/en/solutions/smb/thinkpad-mil-spec-tested-extreme

[45] https://www.dellemc.com/en-us/rugged/index.htm

[46] https://www.zebra.com/gb/en/products/tablets/l10-series-xbook-xslate-xpad.html

[47] Preparatory study on the Review of Regulation 617/2013 (Lot 3) Computers and Computer Servers

On the other hand, some manufacturers at least seem to use the IP marking standard for dust and water resistance for their products (more commonly for tablets and smartphones). When the equipment is expected to be used in specific environment and activities where contact with dust and water is unavoidable, the procurement of at least an IP65-rated tablet or smartphone dustproof design can help protecting the device and data against particle penetration and withstand the pressure of water jets. IP67 or IP68 could help protecting from more severe conditions and risks related to water ingress and could be beneficial only for devices expected to be used under extreme conditions.

Further, according to stakeholder feedback, it was suggested to use internationally acknowledged standards (similar to MIL standard 810-G) with regard to the durability requirement for computer drives.

Finally, IP protection levels for dust and water are proposed to be included as further GPP criteria for tablets and smartphones mainly expected to be used in outdoor activities.

2.1.3.2   Comments from the initial GPP survey 2019

The approach of the durability testing was generally supported. Durability tests were also reported to be introduced by ecolabels as TCO that has set the drop test limit to 45cm after discussions with the industry.

It was suggested to better specify how to determine if a product pass or fail the test.

2.1.3.3   Further background after AHWG meeting and first stakeholder consultation

Some stakeholders highlighted that some of the specifications proposed would be only beneficial for devices expected to be used under extreme conditions. Moreover the request of test results from accredited test bodies is questioned by industry. The use of covers / protective case is also suggested for tablets, considering a lower availability of products that have passed durability tests. The inclusion of different features in one single award criteria is also questioned. In this revision the criterion has been simplified and tests that are not linked to international standards as (e.g. the screen resistance) have been removed.

2.1.4 Criterion 1.4 (new!) Interoperability and reusability of components

New criteria are proposed based on the use of standardised components aiming to increase the ICT equipment interoperability and reusability: in particular regarding connection cables and external power supply units. By using one standardized interfaces for charging and data transfer, fewer cables need to be manufactured and the reuse of chargers and data cables can increase, with a possible saving of resources by decoupling the procurement of chargers from the procurement of the ICT device.

The following table compares the existing GPP criteria with the new proposals.

Table 8: Interoperability and reusability of components current criteria (2016) and TR v2.0

GPP 2016	TR v2.0 Proposal
	New! TS17 Standardized port
	New! TS18. Standardized External Power Supply
	New! TS19. External Power Supply: Detachable Cables
	New! TS20 Backward compatibility: adapters
	New! TS21. ICT Equipment without accessories

Summary of the main changes after the first stakeholder consultation

Minor changes and clarification were integrated in the criteria text. The following table shows the criteria as revised after the AHWG meeting and the first stakeholder consultation.

Second criteria proposal	
Core criteria	Comprehensive criteria

TECHNICAL SPECIFICATION

New! TS17 Standardized port

(same for core and comprehensive criteria)

Applicable to all devices except computer displays

The equipment delivered as part of the contract must carry at least one standardized USB Type-C™ receptacle (port) for data exchange that is backward compatible with USB 2.0 according to the standard IEC 62680-1-3:2018.

If the product does not have a built-in USB Type-C receptacle, then an adapter must accompany the product when it is delivered to the end user.

Verification:

The tenderer must provide a product manual for each model provided, which must include an exploded diagram of the device illustrating the types of connectors used.

Equipment holding a Type I Eco-label fulfilling the specified requirement will be deemed to comply.

The label that currently ensuring the use of at list one USB Type-C connector is TCO Certified, generation 8.

EXPLANATORY NOTE: Standardized USB Type-C™

The USB Type-C™ receptacle is defined according to the standard IEC 62680-1-3:2018 - Universal serial bus interfaces for data and power - Part 1-3: Common components - USB Type-C™ Cable and Connector Specification.

	New! TS18. Standardized External Power Supply
	Applicable to all the mobile devices with a power supply up to 100 W.
	This is not applicable to products with only Qi (wireless) charging capability (e.g. for strong resistance to immersion into water or to dust, such as industrial computers).
	The equipment delivered as part of the contract must carry a USB Type C standardized receptacle (port) for USB Power Delivery (PD) according to the standard EN/IEC 63002:2017.
	If the product does not have a built-in USB PD receptacle, then an adapter must accompany the product when it is delivered to the end user. **Verification**:
	The tenderer must provide a product manual for each model provided, which must include an exploded diagram of the device illustrating the types of receptacle used for power delivery.

EXPLANATORY NOTE: Standardized External Power Supply

Interoperability guidelines for external power supplies are defined according to the IEC 63002:2016 - Identification and communication interoperability method for external power supplies used with portable computing devices.

	New! TS19. External Power Supply: Detachable Cables
	Applicable to all the mobile devices with a power supply up to 100 W

	The External Power Supply (EPS) configuration must consists of an USB EPS with a detachable input cable (or integrated in the EPS housing) and a detachable output cable to the ICT device **Verification**: The tenderer must provide a product documentation for each model provided, which must include an exploded diagram of the device illustrating the main characteristics of the USB EPS.
	New! TS20 Backward compatibility: adapters *Applicable to stationary and portable computers* The following adapters [to be selected from the list below] must be available to be separately procured: • USB-C to USB Type-A • USB-C to VGA • USB-C to HDMI • USB-C to RJ45 (Ethernet Port) **Verification**: The tenderer must provide a product specification and a price list for the adapters required.
	New! TS21. ICT Equipment without accessories *Applicable to all the products in the scope* The equipment model must be available without the following accessories: • External Power Supply (EPS) • Headphone These accessories must be available to be procured separately. **Verification**: The tenderer must provide a quotation of the model with and without these accessories and a separate quotation for each one of the accessories.

2.1.4.1   Initial background and rationale for the proposed criteria

Standardized interfaces:

It is proposed a new criterion on the use of standard interfaces. The proposal is based on the usage of USB-C interfaces as they have the advantage to be:

• Standardized: USB type-C electric receptacles are specified in the IEC 62680-1-3:

Blue Angel has criteria on interfaces, on the one hand connectivity to external monitors, on the other hand the existence of two or more USB 3.0 or later ports. The latest TCO Generation 8 criteria even go beyond and require computers to carry at least – built-in or delivered as separate adapter – one USB-Type C connector which is a universal connector with more pins, different design and performance compared to USB 3.0, that allows both charging and data transfer. According to the TCO criteria document, USB-C is designed to be more robust and future proof than existing USB interfaces, helping to prevent problems with failing ports and to decrease the need for different cables

Standardized external power supply

A new proposal on the Standardised USB type-C receptacles is included for External Power Supply (EPS) for computing devices up to 100 W. This proposal is in line with the new Circular Economy Action Plan[48] that foresees regulatory measures on chargers for mobile phones and similar devices, including the introduction of a common charger, improving the durability of charging cables, and incentives to decouple the purchase of chargers from the purchase of new devices (see TS21).

IEC 63002:20016 defines interoperability guidelines for external power supplies used with portable computing devices that implement the IEC 62680-1-2: Universal Serial Bus Power Delivery Specification with the IEC 62680-1-3: Universal Serial Bus Interfaces for data and power-Common Components- Type-C Cable and Connector Specification. This International Standard is applicable to EPS under 100 watts for portable computing devices, with a focus on power delivery application for notebook computers, tablets, smartphones and other related multimedia devices. A broad market adoption of this International Standard is expected to make a significant contribution to the reusability of power supplies by building on the global market ecosystem of IEC 62680 compliant devices and facilitating interoperability across different product categories.

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[48] COM(2020) 98 final

According to the ITU recommendations[49] the basic configuration of universal power adapter (UPA) solutions consists of a UPA with a detachable input cable (captive input can be a mains plug integrated in the adapter housing) and a detachable output cable to the ICT device.

The Green Product Mark requires using a standardized power supply to enable easy reuse of used power supplies.

External power supply with detachable cables

The recommendation ITU-T L.1002 (10/16) sets out technical specification for common EPS, designed for use with portable ICT devices, also referred in the recommendation as Universal Power Adaptor (UPA). The basic EPS configuration suggested by ITU-T L.1002 consists of an EPS with a detachable input cable[50] and a detachable output cable to the ICT device[51] (see **Error! Reference source not found.**). A detachable DC cable is required as the DC cable is generally the weakest point of the portable power supply and the main point of failure. Adapters which have captive cables, in case of failure of the latter, require all the rest of the equipment and in particular its active part, to be discarded, adding up unnecessary e-waste and cost for the users that could be a barrier for repair. Furthermore, the detachable cable enables more reuse and an increased lifetime of the power supply unit. The Recommendation ITU-T L.1002 also suggests implementing the USB type-C connector for the interface of EPS, in order to support broad reusability and interoperability.

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[49] Recommendation ITU-T L.1002. External universal power adapter solutions for portable information and communication technology devices

[50] Detachable alternating current (AC) cable: A detachable cable used to connect the power adapter to the AC mains for powering through two connectors, one on the universal power adapter side and the other on the AC mains side.

[51] Detachable direct current (DC) cable: A detachable DC cable connects the power adapter to the ICT device for powering through two connectors, one on the universal power adapter side and the other on the ICT device side
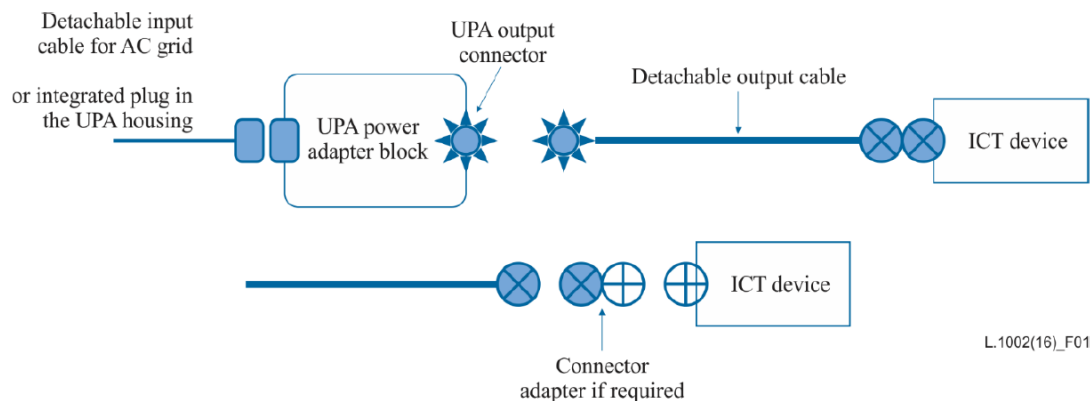
Figure 12: **Basic Universal Power Adaptor (UPA) configurations and connection options (Source: ITU-T 2016)**

Backward compatibility: adapters

The main aim of this proposal is to ensure the future-proofness of the equipment and, at the same time, the connectivity with older equipment and peripherals.

Hardware interfaces and connectors

Product manuals can serve to ensure that the products are compliant with the Technical Specification for USB-C cable and connector. The USB-C connector is defined according to the standard IEC 62680-1-3:2018 - Universal serial bus interfaces for data and power - Part 1-3: Common components - USB Type-C™ Cable and Connector Specification. Labels currently ensuring the use of at list one USB Type-C connector are, among others, TCO Certified generation 8 and Blue Angel.

Avoidance of not necessary accessories

The use of standardized interfaces can make possible that at some point with any standard USB type C charger and cable. As public organisations most probably have already spare chargers and cables, there is no reason to bill them for something they might not need.

2.1.4.2 Initial background for the proposed verification

The verification is mainly based on the demonstration of compliance with the defined standards, based on the technical specifications on the procured products.

2.1.4.3   Further background after AHWG meeting and first stakeholder consultation

Generally positive feedbacks, it was asked for the possibility to provide adapters for USB type C ports when this solution is not applied by the device. Manufacturers also consider complicated to adapt their supply chain in order to provide equipment without accessories. JRC is aware that this measure needs a supply chain re-organization that would need some effort to be implemented by the entire market, however, this is considered as a relevant technical specification as public offices are often full of redundant chargers, cables and other accessories that are not really requested during the procurement that end up as waste without never being used. The environmental and economic benefits of this measure are evident.

2.1.5   Criterion 1.5 (new!) – Recycled Content

Summary of the main changes after the first stakeholder consultation

In the first draft of this report it was proposed a new technical specification (TS22) aiming to support the use of recycled plastic. However, the proposal of this criterion was withdrawn for following reasons:

- **Verification concerns:** The new standard EN 45557:2020[52] introduces horizontal principles for the calculation and verification of recycled content (w/w%) in energy-related products. Despite some certification schemes have been developed for the recycled content certification (e.g. UL ECVP 2809 (3rd edition)[53], SCS Services Recycled Content Standard V7.0[54]), their compliance with the EN 45557:2020 principles and with the Procurement Directive should be further verified;

- **Possible Trade-offs:** The increase of recycled content (w/w%) could, in some cases, come with some trade-offs, as an increase of the use of plastic to ensure the same performance. The mere measurement of the recycled content cannot consider this trade-off.

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[52] EN45557:2020 General method for assessing the proportion of recycled material content in energy-related products

[53] https://standardscatalog.ul.com/standards/en/standard_2809

[54] https://www.scsglobalservices.com/services/recycled-content-certification

- **Comparability:** The use of this criterion is not appropriate to compare the environmental performance of products using plastic with products using alternative materials for casing (e.g. aluminium / magnesium alloy).

- **Relevance:** the criteria area Design for Recycling (see section 2.4.1) already includes different criteria proposals aiming to facilitate the circularity of plastic components from WEEE. Moreover, the life cycle environmental impacts of ICT products are mainly associated to the manufacturing of electronics (e.g. PCB and ICs) and to the extraction and processing of precious metals used in these components[55] and the environmental benefits are relatively smaller compared to other measures.

Finally, it should be considered the necessity expressed by the stakeholders to reduce the number of criteria and thus prioritising criteria with highest environmental benefits / easiest to be verified.

2.1.5.1 Initial background and rationale for the proposed criteria

So far, neither EU Ecodesign regulations nor the EU GPP criteria for computers and monitors include requirements on recycled plastic content. On the other side, EPEAT/IEEE, Blue Angel, Green Product Mark and TCO ecolabel schemes have criteria for the content of recycled and/or biobased plastics.

TCO Certified version 8 requires information about the percentage of post-consumer recycled plastic; this percentage is expected to be published as one of the sustainability performance indicators of the product, which will also be printed on the certificate. Applicants for the TCO ecolabel have to fill out and provide a product declaration which inter alia includes as declared sustainability information the `percentage of recycled plastic by weight of total weight of plastic parts'. Together with the application and product form to be delivered to TCO Development, a copy of the verification report(s) from a verifier approved by TCO has to be submitted. Other ecolabels like Green Product Mark and EPEAT (IEEE Standard)[56] even require a minimum Post-consumer recycled content (PCC).

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[55] Andrae A. (2016) Life-Cycle Assessment of Consumer Electronics - A review of methodological approaches. IEEE Consumer Electronic Magazine, Volume: 5, Issue 1, 51-60. DOI: 10.1109/MCE.2015.2484639

[56] IEEE Std 1680.1™-2018. IEEE Standard for Environmental and Social Responsibility Assessment of Computers and Displays

- Green Product Mark: minimum 10% PCC

- EPEAT (required): minimum 2% of any combination of postconsumer recycled plastic, IT equipment-derived post-consumer recycled plastic or bio-based plastic, measured as a percentage of total amount of plastic (by weight) in the product. Several components might be excluded from the calculation of percentage, differing between normal and 'ruggedized' devices.

- EPEAT Optional criterion require or provide optional points for higher contents of postconsumer recycled plastic, IT equipment-derived post-consumer recycled plastic or bio based plastic, depending on the product type.

According to the IEEE standard, verification of the postconsumer recycled plastic content (for the mandatory criterion) is based on self-declaration of the supplier only, i.e. by supplier letter(s) stating the percentage of applicable content(s) in plastic(s) supplied to the manufacturer or to the manufacturer's part supplier; documentation of calculation, including plastic part name(s) or other part identifiers and the total weight of their plastic content, as well as the weight of plastic content that is post-consumer, IT equipment-derived post-consumer, or bio based, and, if excluding parts, a list of excluded parts and reason for exclusion. In case of the optional IEEE criteria, if supply is temporarily disrupted, the manufacturer shall provide information regarding the disruption, including the dates in which the impacted supply was disrupted and reinstated, the reason for the disruption, and information or attestations from suppliers, and steps the manufacturer is taking to reinstate supply, as relevant.

The analysis of voluntary approaches of companies presented in the preliminary report revealed that many of the manufacturers already make efforts and claim to achieve a certain percentage of postconsumer recycled content in their computer and monitor products. it is proposed to remove4 the proposal on minimum post-consumer recycled content.

2.1.5.2 First Criteria Proposal: summary of the comments received and rationale for the revision

Stakeholders requested to better specify the recycled content thresholds based on product types. It was also suggested to give priority to the stationary devices, as for mobile devices the use of recycled materials could come with trade-offs with reliability. Moreover, it was requested to increase the level of ambition of this criterion.

The CPC is considered too complicated and suggested to be removed. The recycled content claim would be based on a mass balance approach as the use of recycled content could vary over time. At least some months of production data should be monitored to verify to ensure that the claimed recycled content reflects long term production. We can than propose that data collected would refer to the production period(s) previous to the procurement.

Some stakeholders also requested to consider bio-based plastic. However JRC considers that the inclusion of bio plastic would make still more complicated the assessment at this stage. Moreover, currently the use of bio plastics seems to be not relevant for this product group.

One stakeholder appreciated the inclusion of a criterion on recycled plastic content, however had concerns about the verification, especially if this would rely on company based own declarations only. The real percentage will only be an estimation, companies would have to apply a mass balance approach of their own processes.

2.2   Criteria area 2 – Energy Consumption

The criteria proposal presented in this section keeps the focus on the Energy consumption in the use phase, as already included in the current criteria. Several changes in the legal context occurred in the past three years and it is therefore necessary an update of the criteria. The most important changes occurred are:

- the expiration of the EU-US agreement on the Energy Star Programme in February 2018[57]

- the adoption in 2019 of new regulations on ecodesign[58] and energy labelling[59] requirements for electronic displays

The EU ENERGY STAR programme followed an Agreement between the European Community (EU) and the Government of the US to coordinate the energy labelling of office equipment. It was managed by the European Commission and played an important role as ecolabel for the procurement of energy efficient products. The US partner was the Environmental Protection Agency, which started the scheme in the US in 1992. Due to the expiration of the Energy Star agreement the technical specifications and award criteria referring to Energy Star need to be modified as it is not possible anymore to directly refer to Energy Star as required label (see additional discussion in section 2.2.2.1).

Moreover, the proposed criteria on the energy efficiency of computer's monitors have been modified according to the new Ecodesign and Energy Label legislation applicable to displays.

This revision includes the following new proposals of criteria:

- A Technical Specification for the procurement and installation of high efficient desktop thin client solutions, where 'Desktop thin client', according to the Commission Regulation (EU) No 617/2013 means a computer that relies on a connection to remote computing resources (e.g. computer server, remote workstation) to obtain primary functionality and has no rotational storage media integral to the product. The main unit of a desktop thin client must be intended for use in a permanent location (e.g. on a

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[57] https://ec.europa.eu/energy/en/energy-star

[58] https://ec.europa.eu/energy/sites/ener/files/documents/c-2019-2122_1_en_act_part1_v7.pdf

[59] https://ec.europa.eu/info/law/better-regulation/initiative/1948/publication/4145543/attachment/090166e5c2464931_en

desk) and not for portability. Desktop thin clients can output information to either an external or, where included with the product, an internal display;

The following table compares the existing GPP criteria with the new proposals.

Table 9: Energy consumption current criteria (2016) and TR v2.0

GPP 2016	TR v2.0 Proposal
TS1 Minimum Energy Performance of Computers (based on Energy Star) *(core and comprehensive)*	TS1 Minimum Energy Performance of Computers (based on the IEC Standard 62623:2012) *(core and comprehensive)*
TS2 Minimum Energy Performance of Monitors (based on Energy Star) *(core and comprehensive)*	TS2 Minimum Energy Performance of Monitors (based on Energy Label) *(core and comprehensive)*
	New! TS3 Thin Client devices in a server-based network
AC 1 Improvement of energy consumption upon the specified Energy Star Standard *(core and comprehensive)*	AC1. Improvement in the energy consumption upon the specified Energy Consumption threshold for computers (based on the IEC Standard 62623:2012)
	AC2. Improvement in the energy consumption upon the specified Energy Consumption threshold for monitors (based on Energy Label)

Summary of the main changes after the first stakeholder consultation

The energy thresholds for the TS1 is aligned to thresholds applied for Energy Star 7.0 / 7.1 rather than still use the Energy Star 6.1 level[60]. Minor changes were applied compared to the first draft proposal as adding clarifications on the use of labels (TS1, TS3, AC1). Moreover a change in the energy efficiency threshold for displays is proposed (from class E to class D as entry level for the core criteria and from class D to class C for the comprehensive criteria). The AC2 has been modified accordingly. The explanatory note for thin client computers has been moved in the Annex. Further background is available in section 2.2.4. The following table shows the criteria that were revised after the AHWG meeting and the first stakeholder consultation.

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[60] Minor changes were introduced by the 7.1 amendment in comparison to the 7.0 version. Most notably this amendment enables those products meeting the mobile workstation definition to utilize an adder to account for the additional utility and energy consumption of these products.

Second criteria proposal	
Core criteria	**Comprehensive criteria**
TECHNICAL SPECIFICATIONS	

TS1. Minimum Energy performance for computers

Applicable to stationary and mobile computers

(same for core and comprehensive criteria)

The calculated Typical Energy Consumption (E_{TEC}) for each equipment delivered as part of the contract must be less than or equal to the Maximum E_{TEC} requirement as for the Annex III of this document.

Verification:
Tenderers must report the Typical Energy Consumption (E_{TEC}) value, based on testing and calculations according to the IEC Standard 62623:2012.

Products holding a relevant Type I Eco-label or other labelling schemes fulfilling this specified requirement will be deemed to comply. In particular holding one the following labels is considered as proof of compliance:

- Energy Star Version 7.0 or 7.1 or 8.0

- TCO Certified Generation 8 (only in case the certificate show compliance with Energy Star version 7.0, 7.1 or 8.0 thresholds)

- EPEAT 2018 for Computers [based on IEEE 1680.1™ – 2018 Standard for Environmental and Social Responsibility Assessment of Computers and Displays] (as for 02/2018)

- Blue Angel DE UZ-78 Version 2 (as for 02/2017)

As alternative test results obtained by accredited ISO17025 test bodies according to the IEC 62623:2012 standard are accepted as proof of compliance.

TS2. Minimum energy performance of monitors	**TS2. Minimum energy performance of monitors**
Applicable to computer displays	*Applicable to computer displays*
The Energy Efficiency Index for each model delivered as part of the contract must be in the range of Energy Classes A-D as for the energy efficiency classes set out in the Annex I of the Commission Delegated Regulation (EU) No 2019/2013.[61]	The Energy Efficiency Index for each model delivered as part of the contract must be in the range of Energy Classes A-C as for the energy efficiency classes set out in the Annex I of the Commission Delegated Regulation (EU) No 2019/2013.**Verification**
Verification	The tenderer must provide for each model delivered the valid Energy Label issued according to the EU's Energy Labelling framework Regulation (2017/1369).
The tenderer must provide for each model delivered the valid Energy Label issued according to the EU's Energy Labelling framework Regulation (2017/1369).	Products labelled as Class A, B or C, will be deemed to comply
Products labelled as Class A, B, C, or D will be deemed to comply.	
	New! TS3: Thin Client devices in a server-based environment
	Applicable to thin client computers

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[61] The Commission Delegated Regulation (EU) 2019/2013 of 11 March 2019 is supplementing Regulation (EU) 2017/1369 of the European Parliament and of the Council with regard to energy labelling of electronic displays and repealing Commission Delegated Regulation (EU) No 1062/2010 (Text with EEA relevance.)

<table>
<tr><td></td><td>The inclusion of this Technical Specification can be generally taken into consideration in a server based working environment.

The equipment delivered as part of the contract must be classified as "thin client". The Typical Energy Consumption (E_{TEC}) for each equipment delivered must be lower than the E_{TEC_MAX} for Thin Clients calculated as for the Annex II.

Verification

Tenderers must report the Typical Energy Consumption (E_{TEC}) value in kWh, based on testing and calculations according to the IEC Standard 62623:2012 and demonstrate compliance with the E_{TEC_MAX} threshold calculated as for the Annex II for thin client.

Products holding a relevant Type I Eco-label fulfilling this specified requirement will be deemed to comply. In particular holding the following label is considered as proof of compliance:

• Energy Star 7.0, 7.1 or 8.0</td></tr>
<tr><td colspan="2"></td></tr>
</table>

AWARD CRITERIA

AC1. Improvement in the energy consumption upon the specified Energy Consumption threshold for computers

(same for core and comprehensive criteria)

It is recommended to use this criterion in conjunction with TS1 for desktop computers if the products specified are for graphics intensive uses.

Points will be awarded if the product is more energy efficient than the E_{TEC_MAX} value required under TS1.

A maximum of x points [*to be specified*] may be awarded. Points must be awarded in proportion to the improvement in energy efficiency as follows:

- over 80% lower: x points
- 60-79% lower: 0.8x points
- 40-59% lower: 0.6x points
- 20-39% lower: 0.4x points
- 10-19% lower: 0.2x points

Verification:

Tenderers must report the Typical Energy Consumption (E_{TEC}) value, based on testing and calculations according to the IEC Standard 62623:2012. Typicial Energy Consumption reported by a valid Energy Star Certificate can be use as proof of compliance.

AC2. Improvement in the energy consumption upon the specified Energy Consumption threshold for monitors

Applicable to computer displays

Points will be awarded if the product is in an energy class higher than D.

A maximum of x points [*to be specified*] may be awarded. Points must be awarded in proportion to the improvement in energy efficiency Class as follows:

Energy efficiency class	Energy Efficiency Index EEI	Points
A	EEI < 0.30	x point
B	0.30 ≤ EEI < 0.40	0.66x points
C	0.40 ≤ EEI < 0.50	0.33x points

Verification

The tenderer must provide for each model delivered the valid Energy Label issued according to the EU's Energy Labelling framework Regulation (2017/1369).

AC2. Improvement in the energy consumption upon the specified Energy Consumption threshold for monitors

Applicable to computer displays

Points will be awarded if the product is in an energy class higher than C.

A maximum of x points [*to be specified*] may be awarded. Points must be awarded in proportion to the improvement in energy efficiency Class as follows:

Energy efficiency class	Energy Efficiency Index EEI	Points
A	EEI < 0.30	x point
B	0.30 ≤ EEI < 0.40	0.50x points

Verification

The tenderer must provide for each model delivered the valid Energy Label issued according to the EU's Energy Labelling framework Regulation (2017/1369).

2.2.1 Background and rationale for the criteria revision

So far, EU GPP criteria for computers as well as monitors are aligned to the latest Energy Star requirements, referring to the exact versions in the GPP criteria document (Energy Star v6.1 for computers and v6.0 for monitors in the current version of the criteria).

However, due to the termination of the US – EU agreement in February 2018, different approaches are proposed for the criteria related to energy consumption.

2.2.1.1 Computer products

Ideally, the GPP criteria should be aligned to the foreseen EU Ecodesign approach. For computers, the revision of the eco-design criteria (Commission Regulation (EU) No 617/2013) is ongoing. The current Ecodesign and Energy Star approach is mainly based on the measurement of the Typical Energy Consumption (E_{TEC}) based on a combination of use profile under sleep and idle mode. The IEC/EN 62623:2012 can be considered as the main methodological reference for the measurement of the typical energy consumption for desktop and notebook computers. Thus, the proposed GPP criteria refer directly to this standard in order to calculate the 'Annual typical energy consumption (E_{TEC})' defined as the electricity consumed by a product over specified periods of time across defined power modes and states.

The IEC 62623:2012 standard does not set any pass/fail criteria for the E_{TEC}. Thresholds for the E_{TEC} are instead defined based on the energy performance thresholds defined in the Energy Star programme.

The current proposal of criteria aims to find a balance between energy performance, material efficiency aspects (e.g. durability, reparability, recyclability) as well as the use of safer chemicals. For this reason, the simultaneous application of this technical specification together with other technical specification on different aspects has to be duly considered in terms of trade-offs and risk of market restriction.

In the first revision the compliance with the Energy Star 7.0 thresholds was proposed as comprehensive level and Energy Star 6.1 as core level. At the time of publication of the first draft of criteria (November 2019) there were around 1500 computers models compliant with the EU Energy Star version 7, with 850 models of notebooks and 260 desktop computers. In March 2020, there were already 98 more certified models with a total number of 946 notebooks and 298 desktop computers models compliant with Energy Star 7. In comparison the EU Products that were qualified under the EU-US ENERGY STAR programme on the EU market

and according to specification levels in force until 20 February 2018 (Computers specification 6.1) include around 5850 models, (around 2900 desktop computers). Based on the increasing uptake of Energy Star products on the market, it is finally proposed to use Energy Star thresholds based on Energy Star 7.1 for both core and comprehensive level.

Moreover, a new Energy Star specification, the Version 8.0 specification for Computers, finalized on October 15, 2019 will be effective since July 15, 2020. Notebooks and thin clients are not impacted by this specification revision as criteria for these products were amended as part of Version 7.1. Energy Star 8.0 compliant products will be also considered compliant with the proposed criterion.

ENERGY STAR version 7.0, 7.1 and 8.0 for computers, limited to Workstation, requires measurement and disclosure of energy consumption under active state conditions. In particular the workstations must be submitted for certification with the following information disclosed in full:

i. LINPAC benchmark test results, compiler optimizations, and total energy consumed over the duration of the test; and

ii. SPECviewperf benchmark test results, configuration options, total duration of the test, and total energy consumed over the duration of the test.

As shown in Figure 13, according to Mills and Mills (2016)[62], the active consumption for common office activities (including web browsing and video streaming) is comparable for most of the tasks, including video streaming and web browsing. Short idle power seems to be a good proxy for active consumption in an office working environment. Only activities that require high speed performance of powerful graphic cards and CPUs (e.g. gaming) seem to notably increase the level of energy consumptions when used at full load (see figure below).

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[62] Nathaniel Mills & Evan Mills (2016). Taming the energy use of gaming computers. Energy Efficiency (2016) 9:321–338. DOI 10.1007/s12053-015-9371-1
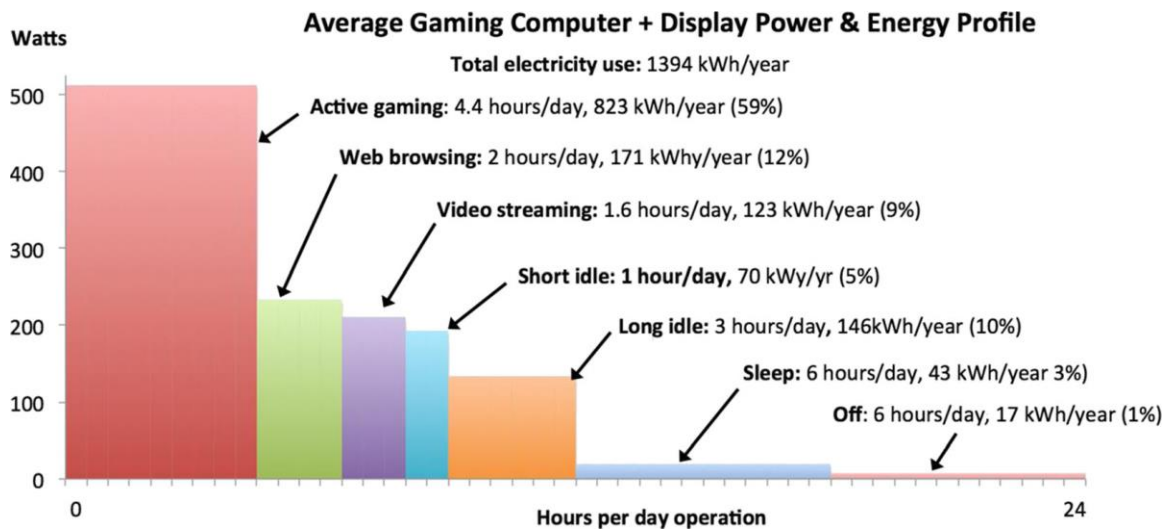
Figure 13: Measured power and energy use for different mode of operation

2.2.1.2 Thin client solutions

Thin clients are simplified devices with fewer hardware components compared to traditional computer devices. In the thin-client paradigm, most of the computation tasks associated with applications can be offloaded to a remote cloud server[63].

In the current GPP Criteria the power-saving solutions are mainly based on the principle of procuring devices with the highest energy efficiency. On the other hand, power can be saved by assuring that a certain task is performed on the location where it will consume the least amount of energy.

In a systemic and strategic approach (instead of an individual product level approach) it is worthwhile looking into the benefits of a thin client base network connected to a data centre / server room. The strategic approach depends on the office's requirements.

This option can be generally taken into consideration where a high number of personal workplaces has to be reached and where users do not need their computer to work on video, audio or graphic files but for normal office applications, databases, internet, etc. which require less computational effort.

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[63] Ghose T., Namboodiri V., Ravi P. (2015), Thin is green: Leveraging the thin-client paradigm for sustainable mobile computing Computers and Electrical Engineering 45, 155–168

The benefits include:

- **Lower energy consumption:** Thin clients generally use far less energy than desktop computers[64]. However, more powerful servers and communications are required that consume additional energy. Real energy savings depend on the overall network system and have to be assessed case by case. Thin client computers currently registered under US Energy Star have an average annual E_{TEC} of 30 kWh[65].

- **More efficient use of computing resources:** A typical desktop computer would be specified to cope with the maximum load for the user needs, which can be inefficient at times when it is not used.

- **Lower noise**. The removal of fans in thin clients reduces the noise produced by the unit.

- **Higher resource efficiency:** Thin client solutions need less hardware and can remain in service longer resulting in a longer lifecycle and better Life Cycle Cost (LCC) performance. Unlike PCs and laptops, which commonly have a three- to four-year replacement cycle, thin clients **last an average of seven years.** They slow down technology's inevitable slide into obsolescence because they have fewer points of failure and rarely need upgrades.

2.2.1.3   Computer monitors

For electronic displays, covering computer monitors, and external power supplies, new EU regulation are available which shall entry into force and apply from 1 April 2020 (Ecodesign regulation for External Power Supplies (EU) 2019/1782) and 1 March 2021 (Ecodesign regulation for electronic displays (EU 2019/2021) and Energy label regulations for electronic displays (EU 2019/2013)).

According to the consultation prior to the adoption of the act most of the displays on the market would fall at the entry into force of the rescaled labels in the class range D to F (see Table 10 and

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[64] Based on the analysis of the EU Energy Star compliant computers at March 2018, the average TEC for desktop computers is around 108 kWh/year, while the average TEC of thin clients is around 36 kWh/year.

[65] https://www.energystar.gov/productfinder/product/certified-computers/results
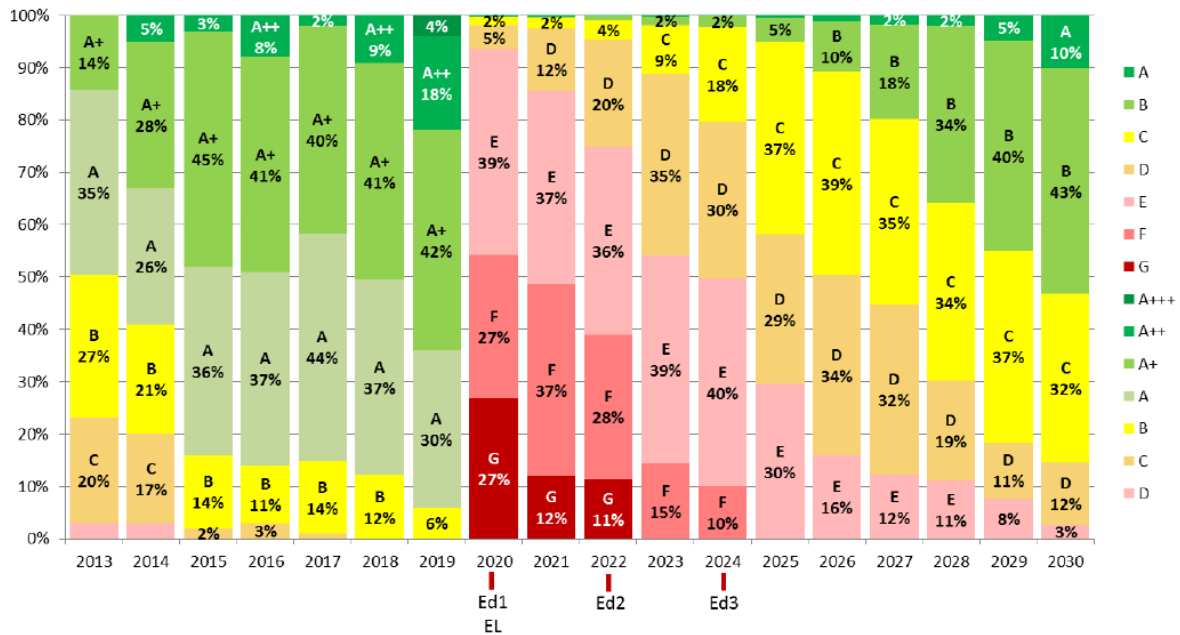
). Based on this, class E was initially proposed as threshold for the Core Criteria and class D as threshold for comprehensive criteria. In the second draft criteria this is proposed to be revised in order to make the criteria more future proof with class D proposed as core criterion and class C as comprehensive. Moreover, the core threshold proposed is in line with the proposal for the revision of EU Ecolabel for displays. It is also proposed applying additional points for computer monitors with better Energy Efficiency Classes as Award Criteria.

However, according to the supplementing Regulation (EU) 2017/1369 of the European Parliament and of the Council with regard to energy labelling of electronic displays there are considerable uncertainties in future projections for this product group because new technologies may result in 'tipping points' improving energy efficiency and new features eroding some savings. For this reason, we consider that an approach proposed based on a Technical Specification + Award Points for better performing is more suitable.

Table 10:   Energy efficiency classes and corresponding Energy Efficiency Index for displays

Energy efficiency class	Energy Efficiency Index (EEI)
A	EEI < 0.30
B	0.30 ≤ EEI < 0.40
C	0.40 ≤ EEI < 0.50
D	0.50≤ EEI < 0.60
E	0.60 ≤ EEI < 0.75
F	0.75 ≤ EEI < 0.90
G	0.90 ≤ EEI
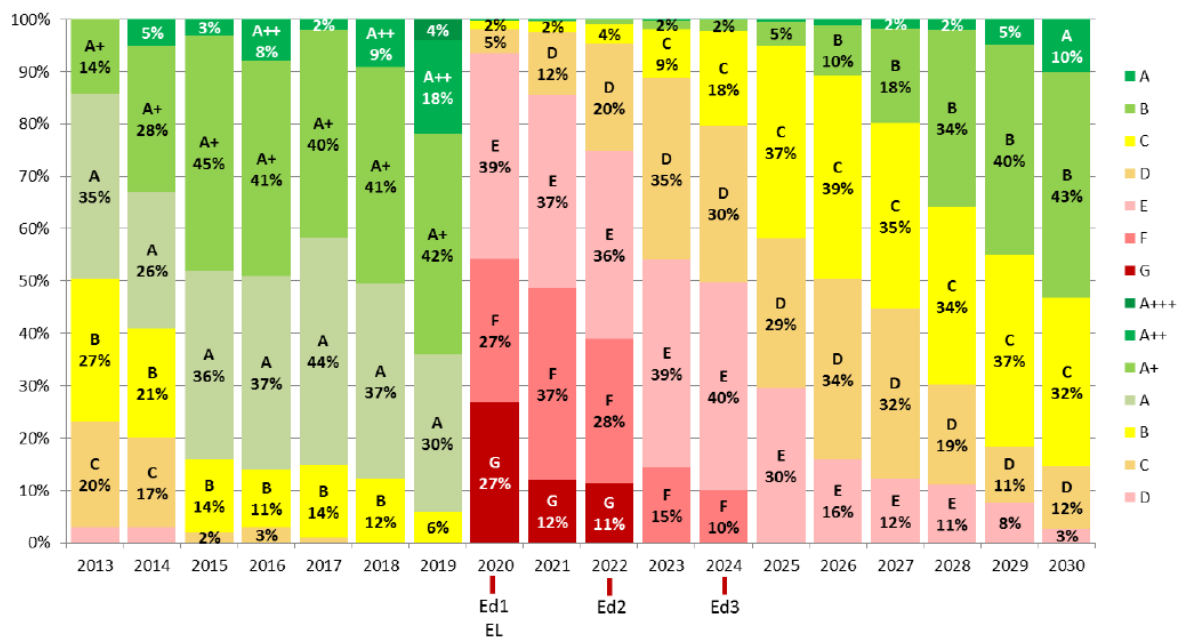
Figure 14: Energy label class distribution of standard electronic display models available in the EU over the period 2010-2030.

Note: actual 2013-2016 and projections 2017-2030) with proposed Ecodesign and Energy Labelling measures

Moreover, as indicated in the initial survey by stakeholders, the awarding of more efficient products can also be achieved via a LCC approach that includes the energy consumption into the model for the total cost of ownership. Parameters as the Typical Energy Consumptions for

computers and the Power in On Mode in (Watts) for displays could be used as basis for the estimation of the operating costs. As showed in Figure 15 below, it has be considered that power consumption is also related to the screen size and an higher energy label class means a lower energy consumption compared to monitor with the same screen size.
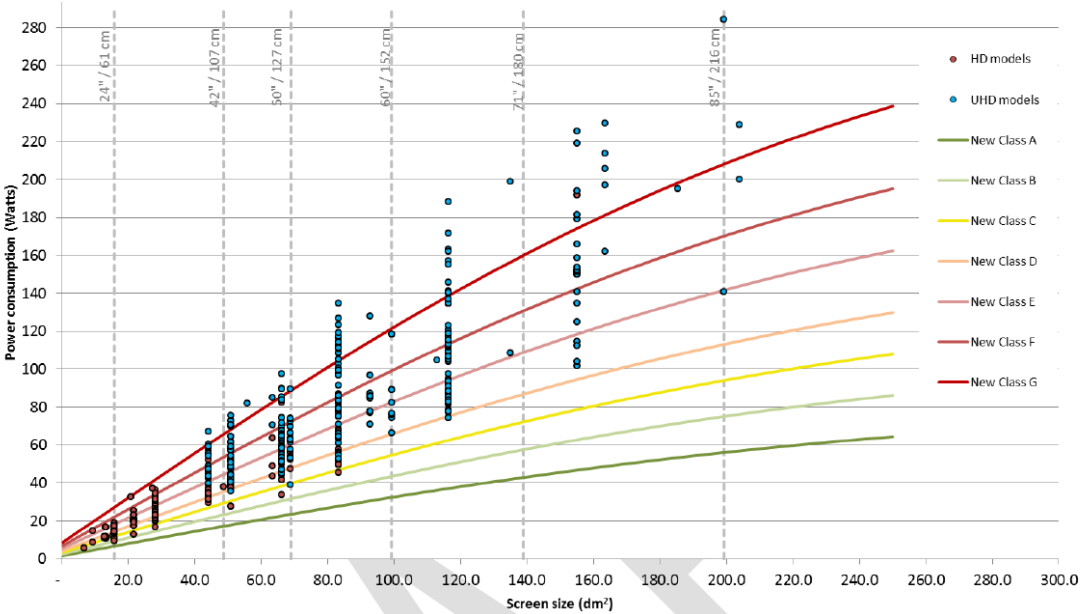
Figure 15: **Distribution of displays from the 2018 dataset with projection of expected improvements at entry into force of the rescaled labels**

2.2.1.4 Batteries

The estimation of how long a battery can last under certain use profiles is possible for computers. Benchmark software like BAPCo MobileMark[66] and PC Mark[67][68] allow testing battery life by installing their software and executing it. Including a requirement on this aspect could be relevant for ICT mobile equipment, where improvements in the energy efficiency can result in a longer battery life. Never the less, it appears that this type of benchmark software does not use a standardised worklets / use profile, which could imply different ranking of

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[66] E.g. https://bapco.com/products/mobilemark-2018/ or PC Mark

[67] https://benchmarks.ul.com/news/pcmark-10-introduces-a-better-way-to-test-battery-life

[68] Please note that these two software tools are provided as example and the authors do not endorse any specific product.

products depending on the software applied. Therefore, it is proposed not to have such criterion in this revision process, although it could be relevant to consider it in future revisions.

2.2.2   Initial background and rationale for the criteria verification

2.2.2.1   Computers

GPP Criteria, when specifying purchasing criteria for office equipment, might draw inspiration from energy performance criteria present in the technical specifications of energy efficiency standards available in third countries (including those of applying the Energy Star programme).

According to this scenario Energy Star compliance is not requested by the TS1, however Energy Star is considered as possible way to proof compliance with the thresholds described in the criteria.

Also for thin clients, in the absence of a specific European threshold for energy efficiency of thin client computers, the US Energy Star Version 7.1 is considered the most relevant reference. In the same way, this criterion does not require Energy Star compliance, however Energy Star can still be considered as possible way to proof compliance.

2.2.2.2   Displays

The entry in force of the new Ecodesign and Energy Labelling Regulation on electronic displays will facilitate the verification of criteria on energy efficiency of displays. It shall apply from 1 March 2021. Tenderers could be requested to provide model identification and related Energy Label. Moreover, public procurers (as well as consumers) will be soon able to surf the "European product database for energy labelling" website[69] for additional products information.

2.2.3   Summary of stakeholder answers from initial survey

According to the answers received the current energy consumption criteria were applied in the past mainly by referring to the provision of Energy Star certified products. While some stakeholders highlighted the need of stricter requirements for energy consumption others are

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[69]   https://ec.europa.eu/info/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/energy-label-and-ecodesign/european-product-database-energy-labelling_en (Accessed on October 2019)

of the opinion that efficiency thresholds introduced by the Energy Star version 7.0 for computers are quite challenging and could be fulfilled only by a 30% to 50% of the products on the market.

In case of requesting label as proof of compliance has been highlighted that it is important to mention the exact version of the label required (and not generally the latest version). One example one provided by a procurer: if one version is released 1st of June and the tender requires this for the offers to be submitted by 5th of June then the products will not have the label in time and thus it would restrict the market".

Although as alternative to the Energy Star certification is possible to show energy consumption protocols / test results, some service providers highlighted the need to re-establish the relationship with Energy Star US and re-establish Energy Star EU.

Relevant procurers have reported is to include the energy consumption in the financial model as part of the total cost of ownership calculation.

2.2.4 Further background after AHWG meeting and first stakeholder consultation

DG JRC informed on the AHWG meeting that no energy consumption criteria are proposed for smartphones. Further, as IEC/EN 62623 standard does not cover measurement of ‚active mode so far, however, the metric ‚Total Energy Consumption (TEC)' which includes ‚short idle' still seems to be quite representative of normal use in office environment. With regard to notebooks' battery-life duration, JRC points out that the performance is a combination of battery capacity and device efficiency, i.e. testing only the battery capacity would not be sufficient; however, standardisation is needed on this issue.

TS1 Minimum Energy performance for computers

For the TS1 core criterion several comments suggested to refer to the current Energy Star 7.0/7.1 rather than still use the Energy Star 6.1 level. Other stakeholders pointed out that there will not be much more efficiency gains in the future and efficiency gains may be done at the expense of performance (e.g. due to reduced luminance). A comparison of the number of products that were Energy Star 7.1 certified at the time of writing the technical report (11/2019) and in 03/2020 showed an increase of 98 certified models with then 946 notebooks and 298 desktop computers models. In the future there might be an acceleration due to the dissemination of innovations. On the other hand, products can't any more be certified with

Energy Star 6.1 since 16th of November 2018. Therefore, certified models are relative old models. Of course, a product could have met the Energy Star 6.1 standard without being certified but Energy Star could no more be used as verification for newer models.

One stakeholder welcomes using the underlying IEC/EN 62623 standard as reference after termination of the EU-US Energy Star agreement. With regard to 'active state', the stakeholder recommends the development of criteria only after a standard is developed, as the current IEC standard does not include a definition or measurement procedure for active state so far. Another stakeholder recommends harmonizing requirements globally, e.g. to align GPP also to the revision of EU Ecodesign for computers which might also not include an active state efficiency metric.

TS2. Minimum energy performance of monitors and AC2. Improvement in the energy consumption upon the specified Energy Consumption threshold for monitors

In one comment it was asked to include Energy Star as possibility to prove compliance with the TS2 core and TS2 comprehensive criteria. Whereas another comment stressed that it is important to put the routes established in EU before the Energy Star. Reply: For TS2 core and TS2 comprehensive the criteria refer to the EU regulation on the energy label to come. The criterion can only be applied in the form described once the regulation has entered into force. At that time the regulation is mandatory. Therefore, it seems not to be necessary and - in order to keep complexity as low as possible - not advisable to include Energy Star here.

One comment stated that the TS2 core and comprehensive criterion as well as the AC2 core and comprehensive criterion are not ambitious enough. The development of the energy efficiency of monitors on the market will overhaul the criteria, given that the next revision of GPP criteria will be several years apart. The comment suggests therefore to delete the lowest energy efficiency class in the TS2 core criterion (=class E) and as well in the TS2 comprehensive criterion (=class D). Consequently, the AC2 core and comprehensive criterion also has to be adapted. Points will only be given to monitors with energy efficiency class A-C resp. energy efficiency class A-B.

The argument of the comment is understandable. According to figure 11 in the TR already in 2021 51% of monitors will have energy efficiency class E or better and in 2023 this will even be 85% of all monitor models. Against this background the level of ambition for TS2 core and TS2 comprehensive was increased as proposed and AC2 core and AC2 comprehensive were adapted accordingly.

New! TS3: Thin Client devices in a server-based environment

One stakeholder stated that for the verification of New! TS3 a list of corresponding type I labels - like for TS1 core and comprehensive - is missing. In the revised version the reference to Energy Star Version 7.0, 7.1 and 8.0 was added.

AC1. Improvement in the energy consumption upon the specified Energy Consumption threshold for computers

One stakeholder suggested to reduce the number of levels for AC1 from 5 to 4 by grouping the two levels above 60% reduction proposed in the Technical Report in only one level. The same award levels as in AC2 core should be used. It was argued that further drastic changes in energy efficiency levels would not be expected and additional levels would add to complexity. One stakeholder added that AC1 would have a greater impact if a certain score was required

The use of AC1 is recommended in conjunction with TS 1 not for all purposes but for desktop computers if the products specified are for graphics intensive uses. The energy demand of these products can be relatively high. Therefore, it seems to be reasonable to differentiate 5 levels in order to reward energy efficient models. At the same time 5 levels seem not to add much complexity for pro-curers in comparison to 4 levels.

New criteria proposed from stakeholders

One comment suggests to include two additional criteria on the "as-shipped" condition: (1) the first concerns the default settings of the power management (the comment refers to Energy Star 7.1, 3.4.2). "This is an easy and a zero-cost measure for suppliers that would allow to save energy"

Reply: The right presettings in the "as-shipped" conditions can help to save energy as users tend to leave the settings as they are. On the other hand, energy demand e.g. for Energy Star, is measured in the "as-shipped" conditions. Against this background the energy measurements already reflect the presettings in the tested models - energy saving presettings as well as energy wasting presettings. Therefore, it seems not to add significantly to include a new criterion that asks suppliers to deliver their products with energy saving presettings.

(2) The second criterion concerns the commitment of suppliers to refrain from preinstalled software that is not necessary for the client (e.g. adware, bloatware). This software potentially can reduce performance, waste storage capacity, and present a security risk.

Reply: To ask suppliers to refrain from the installation of unnecessary software makes sense for several reasons: possibly less need for storage media (positive from environmental point of view), less security risk, better performance. In view of the fact that overall there are to be fewer rather than more criteria and given that there is only a limited link to environmental issues no action is proposed.

Several comments stressed the relevance of the manufacturing phase. To include the total energy demand of the manufacturing phase was considered too difficult but one comment suggested to create a new criterion on the share of renewable energy used in the manufacturing phase (e.g. <25%; 25-50%; 50-75%; >75%).

Reply: As the comment already stated, the total energy consumption of different manufacturers is not comparable. The inclusion of a new criteria concerning the share of renewable energy of the total energy consumption of manufacturing would add disproportionally high complexity as it has to be defined exactly which type of renewable energy will be accepted (see e.g. EPEAT 9.4.2). Not all countries concerned have according certification schemes at their disposal. Against this background it is not proposed to add a new criterion.

One comment suggested the introduction of a new criteria on the climate / environmental impact of the products. As verification a third-party analysis was proposed (e.g. EPD, LCA).

Reply: The effort to provide a third-party certified LCA or EPD for each model would be disproportionately high compared to the benefit or the significance when comparing different products. LCA studies are very helpful when it comes to basic evaluation, e.g. for identifying hotspots or leverage points. The conclusions drawn from them can then be translated into criteria, if necessary. In contrast, demanding LCA results on an individual product level does not bring any significant additional benefit and tends to disadvantage smaller companies that do not have the same resources for conducting LCA studies as large companies. Even for larger companies this might be difficult. Lenovo was cited as one company, that does Product Carbon Footprint (PCF) studies of their products. A check showed that by far not for all models PCF data are available and some of these data are relatively old (e.g. 2015). In EPEAT LCA and PCF are optional. Against this background it is not proposed to add a new criterion.

2.3 Criteria area 3 – Hazardous substances

A range of hazardous substances are used in the manufacturing of ICT equipment that may be present in the final product, this criteria area covers these aspects. Compared to the current set of criteria for hazardous substances, the proposal includes an amendment of the criterion on plasticizers in external cables as some of the former substances are now banned under RoHS directive; a proposal for technical specification for the reduction of halogenated flame retardants has been included, as well as two award criteria proposals, one on the reduction of Substances of Very High Concern (SVHC) and another one on the avoidance of regrettable substitution.

Regarding the AC on EoL emissions it is proposed to remove it, since the responses from the questionnaire indicated that the fire-tests required were costly and difficult, on the other hand the presence of halogenated compounds is now covered with a new TS.

The following table compares the existing GPP criteria with the new proposals as formulated after the AHWG meeting and after the first consultation.

Table 11:   Hazardous substances current criteria (2016) and TR v2.0

GPP 2016	TR v2.0 Proposal
SC1. Restricted substance controls	SC1. Substance controls *(core)*
TS3. Declaration for REACH Candidate List substances	
~~TS4. Plasticisers in external cables~~	~~TS4. Declaration of Substances of Very High Concern (REACH Candidate List substances)~~
	TS5. Restriction of halogenated substances in plastic parts *(core)*
AC2(a) Hazardous end of life emissions from the main Printed Circuit Board (motherboard)	
AC2(b) Hazardous end of life emissions from external power cables	
	AC3 Restriction of Substances of Very High Concern *(~~core and~~ comprehensive)*
	New! AC4 Avoidance of regrettable substitution *(comprehensive)*

Summary of the main changes after the first stakeholder consultation

The reference to the IPC Standard 1752 on Materials Declaration Data Exchange, has been added as additional reference for the Selection Criterion on Substance Control. The technical specification TS4 on the declaration for REACH Candidate List substances has been deleted after the AHWG meeting and after the first consultation. Regarding the TS5 on Restriction of halogenated substances, the comprehensive level proposal has been removed, and the core level proposal is proposed to be applicable both to the core and comprehensive level. The AC3 - Restriction of Substances of Very High Concern, has been limited to the comprehensive level. An explanatory note has been added regarding the definition of Candidate List substances. Regarding the AC4, the proposal has been modified to extend the scope to both plasticizers and flame retardants. It has been also revised the list of tools and methods that are considered applicable for the assessment of material substitution. Further background is available in section 2.3.4.

The following table shows the criteria proposal revised after the AHWG meeting and the first stakeholder consultation.

Second proposal	
Core criteria	**Comprehensive criteria**
SELECTION CRITERIA	
SC1. Substance controls	

(Same for core and comprehensive)

Applicable to all the product categories in the scope

The tenderer must demonstrate implementation of a framework for the operation of Substance Controls (SCs) along the supply chain for the products to be supplied.

Product evaluations according to the SCs should, as a minimum, cover the following areas:

- Product planning/design;
- Supplier conformity;
- Analytical testing.

The SCs must at least outline the REACH Candidate List substances. Implementation should follow the guidelines in IEC 62476 and must use the IEC 62474 material declaration database[70] as the basis for identifying, tracking and declaring specific information about the composition of the products to be supplied. Alternatively, IPC1752[71] can be used for collection of declarations from the supply chain.

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[70] International Electrotechnical Commission (IEC), *IEC 62474: Material declaration for products of and for the electrotechnical industry, http://std.iec.ch/iec62474*

[71] IPC Materials Declaration Data Exchange Standards, http://www.ipc.org/ContentPage.aspx?pageid=Materials-Declaration#1752a

Supplier declarations of conformity with the SCs must be collected and maintained up to date for relevant materials, parts and sub-assemblies of the products to be supplied. These may be supported, where appropriate, by supplier audits and analytical testing.

The SCs procedures must ensure that product and supplier compliance is re-evaluated when:

- restricted substance requirements change;

- if supplied materials, parts and sub-assemblies change;

- if manufacturing and assembly operations change.

Verification:

The tenderer must provide documentation, which describes the system, its procedures and proof of its implementation.

TECHNICAL SPECIFICATIONS

TS5. Restriction of halogenated substances in plastic parts

(Same for core and comprehensive)

Applicable to all the product categories in the scope

Equipment delivered as part of the contract must not contain halogenated substances in plastic parts that weigh more than 25 grams (5 g for smartphones).

Exemptions are:

- Printed Circuit Boards and PVC for cable insulation.

Verification:

The tenderer must provide documentation which proves that the requirement has been met by either:

- Test data showing that the part contains less than 1000 ppm chlorine and less than 1000 ppm bromine (test methods used can be IEC 62321-3-1 or IEC 62321-3-2), or

- Documentation based on the IEC 62474 or similar (e.g. documents produced according to Substances Control system as analytical testing and supplier's conformity assessments).

In case exemptions are used a declaration by the manufacturer must be provided.

Equipment holding the following Eco-label will be deemed to comply:

- TCO Certified Generation 8,

- EPEAT 2018 for Computers [based on IEEE 1680.1™ – 2018 Standard for Environmental and Social Responsibility Assessment of Computers and Displays] (as for 02/2018)

- Blue Angel DE UZ-78 Version 2 (as for 02/2017).

AWARD CRITERIA

	AC3 Restriction of Substances of Very High Concern
	Points must be awarded when no REACH Candidate List substances are intentionally added above 0.1% (weight by weight) in each of the following sub-assemblies:
	• Populated motherboard (including CPU, RAM, graphics units);
	• Display unit (including backlighting);
	• Casings and bezels;

	• External keyboard, mouse and/or trackpad;
	• External AC and DC power cords (including adapters and power packs)
	Compliance to be ensured for the latest version of the REACH Candidate list available at the moment of tendering.
	Verification:
	The tenderer must provide a declaration of compliance with the criterion. Documentation based on the IEC 62474 or similar (e.g. documents produced according to Substances Control system as analytical testing and supplier's conformity assessments) can be used.
	Equipment holding the following Eco-label will be deemed to comply:
	• Blue Angel Blue DE UZ-78 Version 2 (as for 02/2017),
	• EPEAT 2018 for Computers in case the optional criterion 4.1.6.2 Reduction of substances on the EU REACH Candidate List of SVHCs is fulfilled.

Explanatory Note: Candidate List of substances of very high concern for Authorisation

The Candidate List of substances of very high concern for authorisation is published in accordance with Article 59(10) of the REACH Regulation and periodically updated at the ECHA website: https://echa.europa.eu/candidate-list-table

	New! AC4 Avoidance of regrettable substitution
	Points are awarded if the substitution of hazardous substances is assessed so that regrettable substitution (substitution by equally hazardous substances) is avoided and that that safer alternatives are used for the phthalates restricted under RoHS and/or halogenated flame retardants.
	Points are awarded if the tenderer can show that the proposed alternatives have been assessed by methods and tools as indicated by the European Chemicals Agency or the OECD Substitution and Alternatives Assessment Toolbox, e
	Verification:
	The alternative plasticizers and flame retardants have to be indicated by name and CAS number.
	The tenderer must provide evidence that the selected alternative(s) have been assessed by methods or tools for comparative hazard assessment as indicated by the European Chemicals Agency at: https://echa.europa.eu/assess-compare-and-select-substitution or the OECD Substitution and Alternatives

	Assessment Toolbox at http://www.oecdsaatoolbox.org/
	Equipment holding the following Eco-label will be deemed to comply:
	• TCO Certified Generation 8
	• EPEAT 2018 for Computers in case the optional criterion in case the optional criterion 4.1.8.1– Chemical assessment and selection – is fulfilled

2.3.1   Initial background and rationale for the proposed criteria

Substance Controls

The proposed set of criteria for hazardous substances includes the selection criterion (SC1) which requires that suppliers have implemented a framework for the operation of Substance Controls (SCs) along their supply chains. This criterion was already included in the former version, although with a different title (*Restricted Substance Controls*). In the new proposal the restriction of phthalate plasticisers (DEHP, BBP, DBP and DIBP) is no longer included as these phthalates are now banned under RoHS and therefore already mandatory in the EU. Stakeholders have expressed through the 2019 survey the relevance of such requirement. Examples of Control of Substances can be found on the website of the OEMs[72,73]. Scope, substances covered and procedures for the Control of Substance are usually provided in a management document.

Halogenated substances

The restriction on halogenated flame retardants it is well covered among the existing eco-labelling schemes (EPEAT, TCO, TÜV and Blue Angel) although the coverage varies from one scheme to the other as shown in Table 12; for example EPEAT allows exceeding the limits proposed in their requirement when the compound used has a GreeScreen Safer Chemical

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[72]https://www.samsung.com/us/smg/content/dam/samsung/sg/aboutsamsung/2017/environment/pdf/standard-substances-products-en.pdf

[73]https://www.apple.com/environment/pdf/Apple_Regulated_Substances_Specification_Sept2018.pdf

Benchmark of 2,3,4 or when no alternatives can reach that score. An analysis of voluntary approaches from industry (more details in the preliminary report, sections 4.4.5 and 4.4.6) shows that in terms of banning halogenated flame retardants three front-running companies ban them for all their products and one to some, which claims that brominated flame retardants are phased out in notebooks. Also the revised Ecodesign regulation on displays[74] includes a ban of halogenated flame retardants in the enclosure and stand of electronic displays. Based on that, in the specific case of displays this criterion has to be considered as already covered by the mandatory legislation. With such controls from industry on the restriction to halogenated flame retardants and the coverage in the existing eco-labelling schemes, a criterion to restrict halogenated substances has been introduced. The criterion covers all plastic parts of more than 25 grams (5 g for smartphones) with exemptions for PCBs and cable insulation. The criterion includes a maximum concentration values tolerated of 0.1 % by weight of the material in homogeneous materials.

Table 12:   **Criteria on halogenated flame retardants in different eco-labelling schemes**

Scheme	Criterion	Exemptions
EPEAT	Each plastic part in the product exceeding 25 g shall not contain greater than 1000 ppm chlorine or greater than 1000 ppm bromine at the homogeneous level	a) when exceeding the limits the manufacturer shall demonstrate that the compound used has a GreenScreen Safer Chemical Benchmark score of 2, 3, 4 or that no alternatives can achieve those scores b) parts with >25% post-consumer recycled content the maximum level is 5000ppm c) PCBs, cables and wiring, fans, and electronic components
TCO 8	Parts that weigh more than 25 grams (10 g for headsets and 5 g for smartphones) and are made mainly of plastics must not contain flame retardants or plasticizers with halogenated substances or intentionally added halogens as part of the polymer.	PCB laminates, electronic components and all kinds of cable insulation
Blue Angel	Halogenated polymers shall not be permitted in housings and housing parts. Nor may halogenated organic compounds be added as flame retardants. Nor shall any flame retardants be permitted which are classified under the CLP Regulation as carcinogenic of Category Carc. 2 or as hazardous to waters of Category Aquatic Chronic 1	a) Fluoro-organic additives (as, for example, anti-dripping agents) used to improve the physical properties of plastics, provided that they do not exceed 0.5 weight percent b) plastic parts weighing 25 grams or less

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[74] Commission Regulation (EU) 2019/2021 of 1 October 2019 laying down ecodesign requirements for electronic displays pursuant to Directive 2009/125/EC of the European Parliament and of the Council, amending Commission Regulation (EC) No 1275/2008 and repealing Commission Regulation (EC) No 642/2009 (Text with EEA relevance.)

| TUV | Covers product materials | Cables |

REACH Candidate List Substances

From the existing labelling schemes only two schemes, TÜV and Blue Angel, have a mandatory ban of the REACH Candidate List Substances, and at the moment of drafting this report Blue Angel has no licenced products besides keyboards. EPEAT, on the other hand, includes the ban of these substances as an optional criterion (further details on the analysis of existing labelling schemes can be found in the preliminary report, sections 4.4.3 and 4.4.4).

An analysis[75] of voluntary approaches, taken by ICT front-running companies, about the Candidate List Substances in REACH shows that one of the analysed companies claims to restrict the SVHC to all materials (unless preapproved by the company), and another one aims to eliminate all SVHC in a concentration of more than 0.1% w/w by December 31st, 2020. Other companies analysed list the substances under the REACH Candidate List for reporting, declaration and/or monitoring purposes. It seems, therefore, that there is certain interest in industry to take action on the restriction of SVHC. Therefore, an award criterion is proposed (AC3) on the restriction of SVHCs as considered useful for the promotion of this type of initiatives.

Companies supplying articles containing substances Candidate List substances in a concentration above 0.1% weight by weight (w/w) on the EU market have to submit information on these articles to ECHA, as from 5 January 2021. The SCIP database[76] will ensure that the information on articles containing Candidate List substances is available throughout the whole lifecycle of products and materials, including at the waste stage. The information in the database will be made available to waste operators and consumers.

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[75] More details on the analysis of voluntary approached and the list of documents revised can be found in the preliminary report.

[76] https://echa.europa.eu/scip-database

Avoidance of regrettable substitution

The list of restricted substances in Annex II of the RoHS Directive 2011/65/EU[77] has been amended by the Commission Delegated Directive (EU) 2015/863 of 31 March 2015[78]. Accordingly, the four phthalates Bis(2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP), Dibutyl phthalate (DBP) and Diisobutyl phthalate (DIBP) have been added to Annex II and the restriction applies for most product EEE (including computers, displays and smartphones) from 22 July 2019 on. Therefore, the former TS criterion on plasticizers used in external cables has been removed in this first criteria proposal and instead a new AC is proposed. In the first place, it was proposed to award those offers that substitute these plasticizers with safer alternatives. After the AHWG and the first consultation the objective was revised, and a broader scope was proposed. Though, it might be an unusual criterion it is forward-looking because it can contribute to avoid future restrictions of equally hazardous substances that are used as substitutes.

2.3.2   Background for the proposed verification

Manufacturers will be able to demonstrate compliance with the criteria through submission of documentation showing that products have been tested to the appropriate test procedures, or equivalent, and meet the hazardous material content requirements (where relevant). This documentation could take the form of a manufacturer declaration or proven compliance to an ecolabel fulfilling the respective requirements; these are listed for each criterion in the section on verification.

Regarding the avoidance of regrettable substitution, there are methods and tools for comparative hazard assessment listed by the European Chemicals Agency ECHA[79] and by the Organisation for Economic Co-operation and Development (OECD)[80]   One example there is the GreenScreen® for Safer Chemicals, which is already applied by some ecolabels such as e.g. EPEAT or TCO Certified.

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[77]   See the consolidated version and all amendments of the Annexes at: http://ec.europa.eu/environment/waste/rohs_eee/legis_en.htm

[78] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32015L0863

[79] https://echa.europa.eu/assess-compare-and-select-substitution

[80] http://www.oecdsaatoolbox.org/Home/AAGuides

2.3.3   Summary of stakeholder answers from the initial survey

Some stakeholders expressed the difficulty of applying the restricted substance control criterion, given the lack of expertise in that area from the preparers of the tender (who will have to perform the evaluation of the documentation provided). The uncertainty of the market uptake for this criterion was also remarked as a challenge for the application of substance controls criterion.

The declaration of REACH Candidate List substances happens to be considered as an important criterion and some stakeholders confirmed that it has been implemented in tenders. It was questioned the validity of a declaration letter from the manufacturer/CEO as verification method.

Regarding the criterion on plasticisers in external cables, it has been as well applied in tenders, although stakeholders suggest referring directly to RoHS directive at product level rather than to certain parts only.

For the hazardous EoL emissions from components it was suggested to ensure a correct recycling process with an EoL criterion for that. A respondent also argued that fire tests are not possible in practice and that there is low consensus on those tests, although the ban of halogenated flame retardants in PCBs and cable insulation was welcome by some stakeholders.

It was suggested that TCO Certified Edge halogen free display could be reported as verification method for displays, or self-declaration such as The ECO declaration[81].

2.3.4   Further background after AHWG meeting and first stakeholder consultation

There were some overall comments from the AHWG meeting in Seville: to reduce the number of criteria and to include all criteria as technical specification because the adoption of award criteria was questioned. Further concern was raised that the criteria area in hazardous substances would be too difficult for procurers to understand the verification.

The comments submitted during the consultation were quite numerous and, in some cases, showed contradictory position to comments made in the AHWG meeting as well as between

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[81] https://www.ecma-international.org/publications/standards/Ecma-370.htm

each other e.g. claiming too much burden for manufacturers versus affirming that companies are well equipped to handle advanced criteria on hazardous substances in the products.

It was suggested by comments to mention the labels that fulfil the criteria in the verification, which was taken up.

Another comment suggested to insert an example on how a verification could look like maybe for every criterion. In the context of the hazardous substances, the suggestion of a database for the different criteria came up because stakeholders felt that additional information can easily be made accessible and is only retrieved by demand. These comments would need to be completed in a future task, it was noted and communicated to the JRC.

SC1. Substance controls

One stakeholder highlighted the clear objective of the criterion and the opportunity for additional information. Another stakeholder suggested to change it into a core criterion; the comment encouraged to continue with this criterion as IT companies are well equipped to handle advanced criteria on hazardous substances in the products. It was further suggested to supplement the criterion on the comprehensive level with routines on the assessment on how substituting hazardous substances. As methods or tools e.g. the ECHA 5 step-model[82] on substitution of chemicals or methods like Green Screen were proposed.

There was also a contradicting comment that this criterion would be an unnecessary burden on manufacturers and too complex for procurers; instead the comment suggested to provide publicly available product declarations from manufacturers.

Another stakeholder still noted that the scope of substances was unclear (REACH Candidate List and IEC 62474) and how a procurer with limited time for verification should analyse different verification documents.

Another comment claimed that it should be clarified how the verification could look like and what this document should contain.

Based on the stakeholder comments it was decided to transform the requirement on substance control into a core criterion in order to stress it as a focus and prerequisite for restrictions of hazardous substances.

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[82] https://echa.europa.eu/know-your-substances-and-needs-substitution

As for the verification, it was decided to add additional ways to perform a substance control, e.g. Manufacturers can even go beyond IEC 62474 substance declaration list and use full material declarations, e.g. according to IPC 1752 to track all substances instead of only tracking those substances listed in the IEC 62474 database.

It was decided not to implement any demands assessing and substituting substances in the comprehensive criterion as it might be an overburden of the intention behind the criterion. However, instead it was decided taking this aspect up in the award criterion covering the assessment for safer alternatives of hazardous substances.

TS4. Declaration of Substances of Very High Concern (REACH Candidate List substances)

As for the TS4. Declaration of Substances of Very High Concern (REACH Candidate List substances), at the AHWG meeting, the view expressed that two criteria on SVHC are confusing; this should be reduced also against the light of a too high number of criteria in total.

During the consultation it was expressed several times that this criterion covers the already existing legal obligation according to REACH Article 33 to communicate the content of SVHCs in a product along the supply chain. The information is available to the consumer upon request. An extra criterion was therefore seen to provide little information to procurers, especially if broken down per sub-assembly. However, one comment suggested to inform procurers that this about this right to transparency.

It was further mentioned that ECHA will provide the "SCIP database"[2] on substances of very high concern in materials; however, the operative database is scheduled for January 2021; this EU-wide database also has the ambition to extend its scope, in the future to substances of concern in materials.

Several comments recommended to delete the TS, only one comment suggested to make a core criterion out of it. The potential benefits raised by the comment was that the listing of the SVHC could help manufacturers to avoid a bad choice of chemical; there were also potential future product recall issues mentioned.

A suggestion made in one comment was that information about the products should be submitted to the JRC team instead to the procurers so that the JRC could compile a list of used SVHC substances for future GPP requirements.

It is decided to delete the criterion in order to reduce the overall number of criteria. Furthermore, the declaration of SVHC is a legal obligation and should be part of a larger

approach of companies to control the use of substances. The requirements to communicate the content of substances is covered in a broader scope in the criterion on substance controls where SVHC should basically be covered.

TS5. Restriction of halogenated substances in plastic parts

Though the comments from the stakeholders differ to some extent, the feedback given indicated that the criterion as technical specification and core criterion was too advanced, instead it was proposed to make an award criterion out of it.

Furthermore, it was noted several times that an exemption for PVC in cable insulation should be kept. Stakeholders argued differently, e.g. by additional costs (PVC-free cables would only be achievable for about 5-10% of the market) or by the beneficial material properties (low ignitability, comparatively low heat release, absence of flaming droplets, good recyclability) or by the reliable durability.

It was suggested to insert an exemption for the restriction if no reliable alternatives exist or if the hazard of the halogenated flame retardant is assessed.

The use of alternatives, more precisely the assessment of the alternative in order to guarantee that safer alternatives are used, was also commented by another stakeholder.

Still another stakeholder mentioned that the wording would not be in line with industry standards, but that industry would use low-halogen and then referring to bromine and chlorine and not all halogens.

One further comment suggested to exclude the use of HFR in external or accessible parts to avoid exposure of final users to the substances while reducing the legacy chemicals burden overall.

There was also the marking of the plastic parts with the flame retardant used mentioned as formulated in the eco-design requirements for displays.

It was decided to keep the wording as it is line with the eco-design requirements for displays and is also in line with the wording of ecolabel.

The restriction of halogenated parts is not limited to accessible parts to avoid exposure of final users to the substances because human health is not the reason for the restriction but considerations of waste and circular economy.

The suggestion for the marking of the plastic parts is recommended to be taken up in the criterion on the end-of-life criteria set (e.g. for the comprehensive requirement; see section "Other cross-cutting issues").

It was however decided to formulate only one criterion with certain exemptions in order to reduce the overall number of criteria and to focus on the restriction (In the first criteria proposal, the core criterion listed exemptions and the comprehensive did not allow for exemptions.) As the criterion requires that the use of exemptions must be declared, transparency is given at this aspect.

Cross cutting issue recycled plastics

With regards to the restriction of halogenated substances in plastic parts, there were comments with regards to recycled plastics. The comments pointed out that if the plastics contain recycled materials, it might contain halogenated substances to a higher extent.

Plastic containing brominated flame retardants need to be sorted out according to WEEE requirements and is sent to incineration in case the concentration of brominated flame retardants is too high. Therefore, it is estimated that recycled plastics would only contain halogenated flame retardants as contaminants (<1000 ppm). Moreover, there are not enough information to set a limit for plastics with recycled content regarding the chlorinated content.

AC3 Restriction of Substances of Very High Concern

Only few comments were submitted on this award criterion. It was suggested twice to delete this criterion as the restriction of Substances of Very High Concern would not be verified with a level of certainty for third party products or substances that are under review could not be covered.

Another comment questioned whether a core criterion should be formulated here referring to the definition of the GPP website stating that "core criteria are those suitable for use by any contracting authority across the Member States and address the key environmental impacts. They are designed to be used with minimum additional verification effort or cost increases."

It is concluded to keep the criterion only as comprehensive level, as an award criterion and can optional be used by procurers. Moreover, the comprehensive proposal would be more coherent with REACH referring to the 0,1% w/w in components instead of product level. It is a

common objective in Europe to promote the substitution of substances recognized as SVHC listed on the REACH Candidate list to safer alternatives.

The analyses of ecolabel showed that they explicitly refer to an elimination / ban of SHVCs or indirectly avoiding SVHCs by assessing safer alternatives such as TCO (TCO Certified ASL).

However, there remains the risk that manufacturers choose a substitute with equally hazardous chemicals, which are not on the SVHC list, is indeed an issue that is a continuous challenge if certain substances are restricted. The choice for safer alternatives needs to be generally assessed. It was therefore decided that the assessment of substitution should be integrated in the following award criterion.

AC Avoidance of phthalates / Avoidance of regrettable substitution

Some stakeholders gave the feedback that basically the approach of using a white list instead of blacklists was welcomed. One stakeholder still noted that procurers do not have the chemical knowledge and that the criteria on hazardous substances risk being resource-intensive; the stakeholder also stated that lists of substances are difficult to be managed. Still another stakeholder supported this by suggesting simplifying the verification as much as possible.

It was also noted that the heading of the criterion indicates that all phthalates are equally hazardous to those restricted under RoHS and that there might be hazardous plasticizers that are not phthalates.

It was noted that the Greenscreen was agreed but that also other methods should be suggested. The ECHA 5 step-model on substitution of chemicals was also mentioned by another stakeholder.

Based on the comments collected and further background analysis, in this revision it is proposed to expand the scope of this criterion beyond phthalates and expand the reference to other tools for comparative hazard assessment as indicated by the European Chemicals Agency at: https://echa.europa.eu/assess-compare-and-select-substitution or the OECD Substitution and Alternatives Assessment Toolbox at http://www.oecdsaatoolbox.org/.

The intention behind the criterion was that the substitution of the restricted phthalates should be assessed and that substitution with an equally hazardous plasticizer should be avoided. However, the same is basically also an issue for the halogenated flame retardants.

As already mentioned above there were several stakeholder comments at various points at the other criteria that substitution was addressed as an issue, that hazardous substances are not substituted by equally hazardous substances. So, it was decided to reframe this criterion on avoidance of regrettable substitution. Though it is still a challenging criterion it is considered being future oriented: It would prevent an ongoing restriction of substances recently developed and/or recently recognized as being hazardous.

Other cross-cutting issue: Marking of plastics

In the context of restricting halogenated substances in plastic parts, it was addressed by stakeholders that the ecodesign requirements for displays stipulates that "(b) Components containing flame retardants shall additionally be marked with the abbreviated term of the polymer followed by hyphen, then the symbol "FR" followed by the code number of the flame retardant in parentheses. The marking on the enclosure and stand components shall be clearly visible and readable." This comment was considered to address a cross-cutting issue as it is addressed in the area of the end-of life criteria by adding the reference to the ISO 1043-4 Plastics — Symbols and abbreviated terms — Part 4: Flame retardants. It is proposed to address this marking / reporting for the comprehensive criterion for plastics.

2.4   Criteria area 4 – End-of-life management

2.4.1   Criterion 4.1 – Design for recycling

Compared to the GPP Criteria version 2016, it is proposed to maintain the Technical Specification on recyclability of plastic casings. The thresholds for plastic parts size for marking of plastic casings, enclosures and bezels have been updated.

A couple of new proposals were included in the first draft revision:

- Criterion on the "plastic composition" used for casings, enclosures and bezels.

- Battery marking for the correct identification of the chemistry.

- Declaration of Critical Raw Materials

The last two proposals (TS26 and TS27) were then removed after the first stakeholder consultation (see Table 13). The following table compares the existing GPP criteria with the new proposal.

Table 13:   Design for recycling current criteria (2016) and TR v2.0

GPP 2016	TR v2.0 Proposal
TS7(a) Recyclability of plastics casings, enclosures and bezels	TS23(a) Recyclability of plastics casings, enclosures and bezels
TS7(b) Recyclability of plastic casings, enclosures and bezels	TS23(b) Recyclability of plastic casings, enclosures and bezels
	New! TS24 Plastic composition recyclability
TS8. Marking of plastic casings, enclosures and bezels	TS25. Marking of plastic casings, enclosures and bezels
	~~New! TS26 Battery packs marking for the correct identification of their chemistry~~
	~~New! TS27 Declaration of Critical Raw Materials~~

Summary of the main changes after the first stakeholder consultation

Based on the comments received by some stakeholders the applicability of these criteria was limited to the desktop computers and displays, expected to have larger plastic components. The criteria TS23(a), TS23(b) and TS24 were slightly modified in order to ensure coherence with EPEAT that includes similar criteria on the design for recyclability. Regarding TS25 this proposal was limited to the comprehensive level and the applicability to plastic parts with a weight greater than 25 grams. The criteria proposals T26 and T27 were deleted based on the comments received.

The following table shows the criteria as revised after the AHWG meeting and the first stakeholder consultation.

Second CRITERIA PROPOSAL	
Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATIONS	
	TS23(a) Recyclability of plastics casings, enclosures and bezels *Applicable to stationary computers and displays*

	All discrete plastic parts >25 g must not contain a metal insert or fastener that is moulded-in, heat or ultrasonically inserted, or glued-in, unless the metal component is either separable by breaking off from the plastic part or is separable with commonly available tools. Fan impellers are excluded from this requirement.
	Verification:
	The tenderer must provide either:
	1) Documentation that the product does not contain a metal insert or fastener that is moulded-in heat or ultrasonically inserted, or glued-in;
	2) Where metal inserts or fasteners are moulded, heat or ultrasonically inserted or glued into plastic parts, documentation showing how it is separable by way of breaking off from the plastic part or with the use of commonly available tools.
	or
	3) Basis for safety, legal, or technical requirement exemption(s) of a metal insert/fastener, if claimed
	Equipment holding a relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply. In particular holding the following label is considered as proof of compliance:
	• EPEAT 2018 for Computers [based on IEEE 1680.1™ – 2018 Standard for Environmental and Social Responsibility Assessment of Computers and Displays] (as for 02/2018)
	TS23(b) Recyclability of plastic casings, enclosures and bezels *Applicable to stationary computers and displays* The presence of paints and coatings must not significantly impact upon the resilience of plastic recyclate produced from these components upon recycling and when tested according to ISO 180 or equivalent. All discrete plastic parts >100 g must not have an adhesive, coating, paint, or finish that is not compatible with recycling. The following are excluded from this requirement: • Plastic parts with > 25% post-consumer recycled content • Printed circuit boards assemblies and fan impellers • Wires and cables, connectors, electronic components, optical components, acoustic components, ESD components, and EMI components • A metal insert/fastener required for safety, legal, or technical requirements **Verification**:

	The compatibility of a surface coating(s) (adhesives, coatings, paints, or finishes) with recycling shall be demonstrated through either:
	1) Test results showing that the surface coating(s) does not lead to more than a 25% reduction in the notched Izod or Charpy impact at room temperature, as measured using ASTM D256, ASTM E23, ISO 180, or ISO 179-1; one test result can be representative for multiple parts in the event that the same material is used in the parts and that the worst-case application is tested;
	or
	2) A statement from a minimum of three plastics recyclers individually, or at least one plastics recycler processing plastics from electronics and working under an independent entity (e.g., not contract-ed/associated with the manufacturer or contracted with a trade organization), confirming these surface coatings do not negatively impact the recyclability of the plastic;
	or
	3) Supplier letter(s) stating that the percentage of post-consumer recycled content in the plastic part is > 25%
	Equipment holding a relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply. In particular holding the following label is considered as proof of compliance: • EPEAT 2018 for Computers [based on IEEE 1680.1™ – 2018 Standard for Environmental and Social Responsibility Assessment of Computers and Displays] (as for 02/2018)

	New! TS24 Plastic composition recyclability
	Applicable to stationary computers and displays
	Plastic parts with a mass greater than 25 g must be comprised of a single resin or a blend of different resins that is compatible for recycling.
	The following are excluded from this requirement:
	• Printed circuit boards, wires and cables, connectors, electronic components, optical components, acoustic components, ESD components, and EMI components
	Verification:
	The tenderer must provide a list of the plastic parts > 25g including the resin type used and its compatibility with recycling.
	If the plastic part > 25g is made from a blend of resins, the tenderer must provide one of the following:
	Demonstration that the resins have "good compatibility" or "limited compatibility" using Annex C in ECMA-341 Environmental Design Considerations for ICT and CE Products, 4th Edition / December 2010.60 If a plastic part is made up of more than one resin, and "good compatibility" or "limited compatibility" cannot be determined because one or more of the resins is not reflected in ECMA-341 Annex C, the manufacturer shall demonstrate that the resin blend is compatible with recycling using c)2) or c)3) below; or
	2) Test results showing that there is not more than a 25% reduction in the notched Izod or Charpy im-pact at room temperature, as measured using ASTM D256, ASTM E23, ISO 180, or ISO 179-1; one test result can be representative for multiple parts in the event that the same material is used in the parts and that the worst-case application is tested; or
	3) A statement from a minimum of three plastics recyclers individually, or at least one plastics recycler processing plastics from electronics and working under an independent entity (e.g., not contract-ed/associated with the manufacturer or contracted with a trade organization), confirming the resin blend does not negatively impact the recyclability of the plastic.
	Equipment holding a relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply. In particular holding the following label is considered as proof of compliance:
	• EPEAT 2018 for Computers [based on IEEE 1680.1™ – 2018 Standard for Environmental and Social Responsibility Assessment of Computers and Displays] (as for 02/2018)

	TS25. Marking of plastic casings, enclosures and bezels
	Applicable to stationary computers and displays
	External plastic casings, enclosures and bezels with a weight greater than 25 grams must be marked in accordance with ISO 11469 and ISO 1043 Section 1 and 4. Plastic parts are exempted from marking in the circumstances described by the explanatory note below.
	Verification:
	The tenderer must identify the plastic parts by their weight, their polymer composition, and their ISO 11469 and ISO 1043 markings. The dimension and position of the marking must be visually illustrated.
	Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply. In particular holding the following label is considered as proof of compliance:
	• TCO Certified, Generation 8
	• EPEAT 2018 for Computers [based on IEEE 1680.1™ – 2018 Standard for Environmental and Social Responsibility Assessment of Computers and Displays] (as for 02/2018)

EXPLANATORY NOTE: Plastic components are exempt from marking requirements in the following circumstances:

(i) the marking is not possible because of the shape or size;

(ii) the marking would impact on the performance or functionality of the plastic component; and

(iii) marking is technically not possible because of the molding method.

For the following plastic components, no marking is required:

(i) packaging, tape, labels and stretch wraps;

(ii) wiring, cables and connectors, rubber parts and anywhere not enough appropriate surface area is available for the marking to be of a legible size;

(iii) PCB assemblies, PMMA boards, optical components, electrostatic discharge components, electromagnetic interference components, speakers;

(iv) transparent parts where the marking would obstruct the function of the part in question.

2.4.1.1   Initial background and rationale for the proposed criteria

Plastic composition / recyclability

It is proposed to maintain the current EU GPP criteria on material composition of plastic casings, enclosures and bezels, in order to eliminate barriers for recycling due to metal inserts,

coatings and flame retardants. The usage of such materials can impact the quality of the recycled resin obtained in terms of physical/mechanical properties.

In general, high product complexity hinders recycling. While sorting and recycling processes and technologies have improved in the past years increasing product complexity continues to generate costs and reduce the quality of recycled materials. Such complexity is, for example, expressed through the types of materials, compounds, adhesives, pigments and other additives used in the product.

Following the aim of reducing recycling burdens, a new TS has been proposed to limit the type of resins used to produce plastic parts heavier than 25 g. The requirement allows to only use resins that are compatible with recycling technologies. Similar requirements are already implemented by type I ecolabels like IEEE, Blue Angel and Green Product Mark, although their restrictions differ from one label to another, as for example Blue Angle and Green Product Mark allow for a maximum of 4 types of plastic in a blend (see the preliminary report for further details on the criteria used in other ecolabels).

Marking of plastics

As discussed in the preliminary report (section 4.3.3), the current EU GPP Criteria for Computers and Displays, most of the analysed ecolabel schemes as well as the revised EU Ecodesign regulation on displays (which shall apply from 1 March 2021) have criteria with regard to marking of plastic parts to facilitate recycling processes, referring to ISO 11469 and/or ISO 1043 sections 1-4, however there are slightly differences with regard to the components covered or exempted, the weight and size of plastic parts to be marked and the specific marking reference, Table 14.

Table 14: **Analysis of EU GPP and ecolabel schemes: Differences in criteria on marking of plastic parts**

	Components	Weight / size of plastic parts for which the requirements apply	Marking reference
EU GPP	External plastic casings, enclosures and bezels	Core: Weight greater than 100 grams and a surface area greater than 50 cm² Comprehensive: Weight greater than 25 grams for tablet and portable all-in-one	Core: ISO 11469 and ISO 1043 section 1 Comprehensive: ISO 11469 and ISO 1043, sections 1-4

	Components	Weight / size of plastic parts for which the requirements apply	Marking reference
		notebooks and 100 grams for computers and monitors and in all cases a surface area greater than 50 cm²	
IEEE	All discrete plastic parts; excluded from the requirement: printed circuit boards; wires and cables, connectors, electronic components, optical components, acoustic components, ESD components, and EMI components	Weight greater than 25 grams	ISO 11469/1043, excluding optical parts
Blue Angel	Plastic parts; Exempted: transparent plastic parts the function of which requires transparency (e.g. visible plastic films in displays)	Mass greater than 25 grams each and an even surface of more than 200 mm²	ISO 11469 with due regard to ISO 1043, parts 1-4
Green Product Mark	Plastic components	Weight greater than 25 grams	ISO 11469
TCO	Parts made mainly of plastics; exempted are printed wiring board laminates as well as plastic parts containing other materials in any significant amounts	Weight greater than 25 grams	ISO 11469 and ISO 1043, sections 1-4
Ecodesign Regulation on Displays	Plastic components; Plastic components are exempt from marking requirements in the following circumstances: (i) The marking is not possible because of the shape or size; (ii) The marking would impact on the performance or functionality of the plastic component; and (iii) Marking is technically not possible because of the molding method. Marking is not required for (i) Packaging, tape, labels and stretch wraps; (ii) Wiring, cables and connectors, rubber parts and anywhere not enough appropriate surface area is available for the marking to be of a legible size; (iii) PCB assemblies, PMMA boards, optical components, electrostatic discharge components, electromagnetic interference components, speakers; (iv) Transparent parts where the marking would obstruct the function of the part in question. Components containing flame retardants shall additionally be marked with the abbreviated term of the polymer followed by hyphen, then the symbol "FR" followed by the code number of the flame retardant in parentheses. The marking on the enclosure and stand components shall be clearly visible and readable.	Weight heavier than 50 grams	'Appropriate standard symbols or abbreviated terms set between the punctuation marks '>' and '<' as specified in available standards.

In order to be aligned with the revised Ecodesign requirement for displays and the existing ecolabel schemes, it is proposed to update the current EU GPP criterion on plastic marking to parts heavier than 50g for the core criterion and parts heavier than 25g for the comprehensive.

Marking of plastic parts is implemented by some manufacturers that have own initiatives for closed loop recycling.

Battery marking for recycling

The increased demand of portable electronics such as notebook computers, tablets and smartphones has stimulated the market of battery recycling. According to the preparatory study for Ecodesign requirement on computers, batteries collected at the EoL mostly appear as mixtures and are subject to manual sorting according to their chemistries. However, when the batteries reach the recycling facility, the logos are sometimes missing, making identification and sorting difficult.

To address such issues it was initially proposed in this revision to include a TS on battery marking following IEC 62902:2019. The proposal includes also the indication of the metals present in the battery cell, or pack, in weight percentage higher than 1. This would allow the improvement of batteries' recyclability with further information on the composition. This proposal has been removed after the first stakeholder consultation (see details in the section 2.4.1.3

Declaration of CRM

CRMs are the raw materials that combine a high economic importance to the EU with a high risk associated with their supply. The criticality of these materials is also associated to low substitutability and low recycling rates. Including a requirement on declaration of the CRM contended in the products has been identified as a relevant measure to reduce risks associated with CRM supply.

The new set of Ecodesign requirements for servers and data storage products (EU2019/424) includes the following criterion:

- From 1 March 2020, the following product information on servers and online data storage products shall be made available from the time a product model is placed on the market until at least eight years after the placing on the market of the last product of a certain product model free of charge by manufacturers, their authorised representatives and

importers to third parties dealing with maintenance, repair, reuse, recycling and upgrading of servers (including brokers, spare parts repairers, spare parts providers, recyclers and third party maintenance) upon registration by the interested third party on a website provided:

- indicative weight range (less than 5 g, between 5 g and 25 g, above 25 g) at component level, of the following critical raw materials:

(a) Cobalt in the batteries;

(b) Neodymium in the HDDs

For the products under the scope of this EU GPP criteria revision (desktop computers, monitors, laptops, tablets and smartphones) a list of parts containing CRM has been identified, Table 15. Initially a criterion requesting the tenderers to provide a document declaring the indicative weight range of the CRM that are present in the parts listed in Table 15 that apply to their product has been proposed. This proposal has been removed after the first stakeholder consultation (see details in the section 2.4.1.3).

Table 15:   List of CRMs present in the products under scope

Part	CRM
Battery (portable devices)	Cobalt
HDD (all type of devices)	Neodymium and other rare earth elements
Display panels	Indium
Vibration module	Tungsten
PCBs	Palladium

2.4.1.2   Comments from the initial GPP survey 2019

Recyclability of plastics casings, enclosures and bezels

No applications of the criterion have been reported. A respondent considers this not fully targeting the real issues: as most recycling facilities now and in the future are going to be automated, meaning that the product is shredded and separated by chemical or mechanical processes, verification process of the TS7b is considered that may be challenging and costly. Especially if verification is needed for all plastic parts before a certificate can be issued. The

study team considers that contamination of waste streams is still an issue in the recycling of plastics and this type of requirements can help in the transition to more circular products.

For the TS about marking of plastic casings, enclosures and bezels, the same stakeholder highlighted that it is much more important to reduce the contamination of the plastic by reducing hazardous chemicals than marking them.

2.4.1.3   Further background after AHWG meeting and first stakeholder consultation

TS23(a) Recyclability of plastics casings, enclosures and bezels (comprehensive criterium)

One stakeholder pointed out that this criterion only has a low sustainability value for small products like e.g. notebooks as they are grinded and not separated. Additionally, the stakeholder stated that metal inserts can prolong the lifetime of ICT products with at the same time a probably limited negative impact. Another comment suggested to align the criterion with EPEAT in order to widen the options for purchasers. One comment proposed to change TS23(a) from a comprehensive criterion to an award criterion as it is a new criterion.

Reply: The metal inserts addressed by the criterion disturb the recycling process and there exist alternatives (e.g. metal foils). An alignment of TS23(a) with EPEAT would mean that EPEAT can be used for verification. It is assumed that this would facilitate the purchasing process for procurers even though some adaptations have to be done (e.g. restriction of the criterium to discrete plastic parts > 25g). Against this background the revised criterion has been aligned to EPEAT and EPEAT as relevant Type I Eco-label for verification. TS23(a) is not a core criterion but a comprehensive criterion and limited to desktop computers and displays. The fact that TS23(a) is a new criterion seems not to be a persuasive argument to change it to an award criterion.

TS23(b) Recyclability of plastic casings, enclosures and bezels (comprehensive criterion)

Two comments asked for an alignment of TS23(b) with EPEAT in order to make it easier for purchasers to use the GPP criteria. Two comments asked for an exemption for parts resp. casings that contain >25% recycled content, as these still have / might have such paints and coatings. One comment suggested to exempt refurbished products from this criterion.

Reply: As for TS23(a) the alignment of the criterion with EPEAT has the advantage that EPEAT can be used for verification. It is assumed that this would facilitate the purchase process for procurers in comparison to the current criterion where there is no Type I label that can be used

for verification. In EPEAT an exemption is already included for parts with >25% recycled content. Against this background the revised criterion has been aligned to EPEAT and EPEAT as relevant Type I Eco-label for verification. The treatment of refurbished products within GPP is an horizontal issue. Therefore, it is defined in a separate chapter of the TR which GPP criteria will apply for refurbished products and which will not apply.

New! TS24 Plastic composition recyclability (comprehensive criterium)

One stakeholder asked for the alignment of New! TS24 with EPEAT in order to give procurers more options.

Reply: with the same arguments as for the alignment of TS23(a) and TS23(b) to EPEAT the revised criterion TS24 has been aligned with EPEAT.

TS25 Marking of plastic casings, enclosures and bezels (comprehensive)

Two stakeholders asked to remove the 5 g threshold for smartphones as it is currently not required by ISO 11469 and ISO 1043, it is difficult to realize as the pieces are small, and it is questionable why the 5g threshold should only apply to smartphones. In contrast to this, one comment suggested to include the 5 g threshold for smartphones not only in the comprehensive criterion but also in the core criterion TS25. In this comment additionally it is suggested to ask for the marking of flame retardants in plastics as it is included in the ecodesign requirements for displays (Commission Regulation 2019/2021).

Reply: Weighing up the expected effort and potential benefits from the 5g threshold for smartphones, it was deleted in the revised criterion. The marking of flame retardants is also included by the reference to the ISO 1043-4:1998 Plastics — Symbols and abbreviated terms — Part 4: Flame retardants.

New! TS26 Battery packs marking for the correct identification of their chemistry

Three stakeholders asked to delete the criterion as is would help neither recyclers nor procurers. They stated that the Battery Association of Japan (BAJ) had used a similar mark but then gave it up and ask to check this for the revision of the criterion.

Reply: To demand an indication of all metals would bring transparency to the market which would also help recyclers. Economically interesting for recyclers is mainly Cobalt, but if an indication is demanded this should not be restricted to Cobalt. In principle a strong instrument

(like Ecodesign) would be needed that obliges an indication on all batteries. GPP could prepare for such a strong instrument but would for itself not be able to push battery producers to indicate the metals an all batteries.   Concerning the hint on BAJ no evidence was found, that in Japan there had been a label on the market that indicated the content of specific metals as weight percentage. On the website of BAJ the revised labelling is explained: http://www.baj.or.jp/e/recycle/recycle11.html   The label indicates the metal with the highest weight percentage but it does not indicate the exact percentage, neither from the metal with the highest share nor from other metals contained in the battery. Additionally, it has to be indicated in case "Tin (Sn)" content in a single cell is more than 1.0 wt% per single cell weight and in case "Phosphorous (P)" content in a single cell is more than 0.5 wt% per single cell weight. Both would hinder the recycling. TS26 was deleted for the revised version of the criteria.

New! TS27 Declaration of Critical Raw Materials

One stakeholder fears that the data necessary for verification are only available to the manufacturers. Two stakeholders strongly suggested to delete this criterium for several reasons: the information on CRM content might be interesting for researchers and recyclers but data are not available for single products to manufacturers but only representative products and only with high effort. Additionally, the information on CRM is difficult to assess by procurers.

Reply: As for the batteries, it is in principle a good idea to have more market transparency concerning the CRM. Still there are several difficulties: Manufacturers do not have the information on CRM at the moment. It is questionable if GPP is strong enough to push the declaration of CRM on ICT products.   Against the background of the comments the criterion TS27 was deleted for the revised version of the criteria.

2.4.2   Criterion 4.2 – Design for dismantling

The AC Product dismantling potential is not supported by respondents from industry in absence of standardised methods. The criterion AC10 on this topic of the current EU GPP criteria is proposed to be removed.

Results from the study 'Analysis and development of a scoring system for repair and upgrade of products', where the disassembly time is listed as one of the key parameters, concludes not to apply this type of requirement to the analysed product groups (being notebooks one of

them). The reasoning for laptops is that although this parameter can be relevant since the repair duration affects repair costs, disassembly time is also covered indirectly by other parameters (e.g. disassembly depth, fasteners, tools, availability of repair information). The study also concludes that methodological developments are still needed before such parameter can be measured in a standardised and not-too-burdening way. The same arguments are also valid to the disassembly time for recycling operations,

2.4.3 Criterion 4.3 – End-of-life management

As result of the initial survey, minor changes are applied to the technical specification and the CPC criterion. On the other hand, the award criteria have been removed as they are already covered in the technical specification or they were considered too complex for its implementation by tenderers.

The following table compares the existing GPP criteria with the new proposals.

Table 16:   End-of-life management current criteria (2016) and TR v2.0

GPP 2016	TR v2.0 Proposal
TS1. Secure computer collection, sanitisation, re-use and recycling	TS28. Secure computer collection, sanitisation, re-use and recycling
AC1. Inventory tracking system	
AC2. Dismantling to facilitate recycling	
CPC1. Reporting on equipment status	CPC3 Reporting on the end-destination of ICT equipment
CPC2. Operation of reuse and recycling facilities	

Summary of the main changes after the first stakeholder consultation

This criterion proposal was kept almost identical. The following table shows the criteria that were revised after the AHWG meeting and the first stakeholder consultation.

Second criteria proposal	
Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
TS28. Secure computer collection, sanitisation, re-use and recycling *Procurement of end-of-life management services for all the ICT devices* Tenderers must provide a service for the re-use and recycling of the whole product or of components requiring selective treatment in accordance with Annex VII of the WEEE Directive for equipment that has reached the end of its service life. The service must comprise the following activities: • Collection (take back system); • confidential handling and secure data erasure (unless carried out in-house);	

- functional testing, servicing, repair and upgrading to prepare products for re-use[83];

- the remarketing of products for re-use;

- dismantling for component re-use, recycling and/or disposal.

In providing the service, they must report on the proportion of equipment prepared or remarketed for re-use and the proportion of equipment prepared for recycling.

Preparation for re-use, recycling and disposal operations must 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 and with reference to the list of components for selective treatment [see accompanying explanatory note].

Verification:

The tenderer must provide details of the arrangements for collection, data security, preparation for re-use, remarketing for re-use and recycling/disposal. This must include, during the contract, valid proof of compliance of the WEEE handling facilities to be used.

EXPLANATORY NOTE:

The following are components requiring selective treatment in accordance with Annex VII of the WEEE Directive:

- mercury containing components,
- batteries,
- printed circuit boards greater than 10 cm^2,
- plastic containing brominated flame retardants,
- chlorofluorocarbons (CFC), hydrochlorofluorocarbons (HCFC) or hydrofluorocarbons (HFC), hydrocarbons (HC),
- external electric cables,
- polychlorinated biphenyls (PCB) containing capacitors,
- components containing refractory ceramic fibres,
- electrolyte capacitors containing substances of concern,
- equipment containing gases that are ozone depleting or have a global warming potential (GWP) above 15,
- ozone-depleting gases must be treated in accordance with Regulation (EC) No 1005/2009.

CONTRACT PERFORMANCE CLAUSES

CPC3 Reporting on the end-destination of ICT equipment

To be used in conjunction with TS28

The contractor must provide a report on the status of the equipment in the inventory once all items have been processed for re-use, recycling or disposal. The report must identify the proportion of items re-used or recycled, and whether they remained in the EU or were exported.

For equipment and components recycled in the EU, the following means of proof for the handling facilities must be accepted:

- a permit issued by the national competent authority in accordance with Article 23 of the Directive 2008/98/EC, or

- a third-party certification of compliance with the technical requirements of EN 50625-1 or an equivalent compliance scheme.

Where equipment and components are exported for re-use or recycling, contractors must provide the following shipment and treatment information:

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[83] Some Member States have developed standards and/or schemes that public authorities may wish to refer to in order to provide greater detail on how equipment is to be made suitable for reuse and resale.

- shipping information for equipment intended for re-use, in accordance with Annex VI of WEEE Directive 2012/19/EU.

For WEEE exported to be treated outside the EU, a third-party certification of compliance with the minimum WEEE requirements laid down in the criterion, or with the technical requirements of EN 50625-1 or an equivalent compliance scheme[84].

2.4.3.1   Background and rationale for the proposed criteria

EU GPP, IEEE and TCO have dedicated requirements on take-back schemes. It has to be noted, however, that in Europe the collection and recycling is regulatory approached by the WEEE legislation with extended producer responsibility for the participation and/or financing of collection and recycling processes. Therefore, the proposed TS28 is formulated in a way going beyond WEEE to further enhance recycling and reuse processes, e.g. requiring reporting on the status of on the proportion of equipment prepared or remarketed for re-use and the proportion of equipment prepared for recycling. Traceability and reporting on the reuse and recycle of the refreshed devices during the contract performance (CPC3) can be triggered by blockchain systems (see as example http://www.usody.com/?page_id=1055).Comments from the GPP survey 2019

Secure computer sanitisation, re-use and recycling

Some public administrations have recycling covered through different framework contracts and are not included in the contracts covering the products purchase. Respondents reported to have applied this TS in some tenderers and suggested to add a sentence clearly requesting that data has to be securely erased before the equipment reuse. Also, some stakeholders suggested referring to standards for Asset Disposal services (e.g. ADISA)

Dismantling to facilitate recycling:

Different opinions from the respondents, someone consider it challenging, others consider this should be standard.

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[84] The following compliance schemes are considered, at the time of writing, to meet these requirements: WEEELABEX:2011 requirement on 'Treatment of WEEE'; 'Responsible Recycling' (R2:2013) standard for electronics recyclers; e-Stewards standard 2.0 for Responsible Recycling and Reuse of Electronic Equipment; Australian/New Zealand standard AS/NZS 5377:2013 on 'Collection, storage, transport and treatment of end-of-life electrical and electronic equipment'

Reporting on equipment status

It was commented that a product can be stripped for parts. This will result in some parts reused and some waste. So, a third category is requested to be added.

Operation of re-use and recycling facilities

Requested to specify which certificates are needed. It is commented that no certificate needed for re-use.

2.4.3.2 Further background after AHWG meeting and first stakeholder consultation

TS28 Secure computer collection, sanitisation, re-use and recycling

One stakeholder pointed out that providing a service for the re-use "and" recycling should be rather an „or"-criterion. It suggested further on to refer only to the WEEE Directive instead of including a list in the explanatory note. A second comment refers to a comment on the GPP criteria on data centres and server rooms and suggests to use an IT Asset Disposal specialist above manufacturers due to higher reuse rates.

Reply: The proposed criterion aims to go beyond the legal compliance, for this reason the proposal aims to ensure that the re-use option is provided by the tenderer. Concerning the use of an asset disposal specialist, the criterion proposal goes in this direction because it allows to have a separate procurement service for end-of-life services.

CP3 Reporting on the end-destination of ICT equipment

One comment suggests to include the R2 standard on responsible recycling (see https://sustainableelectronics.org/r2-standard) and to delete the reference to T30.

Reply: Tenderers as well as purchasers may use a certain flexibility and refer to existing reporting schemes when reporting on re-use and recycling if the key points mentioned in the criterion are respected. GPP criteria address explicitly environmental issues and do not include social criteria as included in the R2 standard. The correct reference has been included (T28 and not T30).

New criterion proposed on packaging material

One stakeholder suggested a new criterion on packaging material including requirements on hazardous substances and the content of recycled material in packaging. It therefore refers to TCO Certified, generation 8, Nordic Label and 2013's Italian Minimum Environmental Criteria.

Reply: In comparison to the ICT products the packaging is less important concerning its environmental impact. Additionally, one can argue that packaging plays a role in the protection of ICT products during transport and prevents damaging. Against this background and the aim to keep the criteria overall slender and feasible no new criterion on packaging was added in the revised version of the GPP criteria.

2.5 Criteria area 5 – Criteria proposals for „refurbished / remanufactured products" (separate procurement route)

2.5.1 Initial background and rationale for the proposed criteria

In criteria area 3, several requirements are listed which public procurement authorities can set as criteria for <u>new</u> IT products to ensure that their product lifetime is extended as much as possible (e.g. design for reparability, reusability and upgradability, quality of the battery, or design for durability). However, another relevant option of facilitating "product lifetime extension" is the procurement and use of <u>refurbished / remanufactured</u> IT equipment.

Moreover, according to the Circular Economy Action Plan a Circular Electronic Initiative foresee improving the collection and treatment of waste electrical and electronic equipment including by exploring options for an EU-wide take back scheme to return or sell back old mobile phones, tablets and chargers.

A second use of IT products can be ensured through:

- a refurbishment / reconditioning process

- a remanufacturing process

- a preparation for reuse (in the specific case the product has been discarded and is managed according to the WEEE legislation).

As introduced in section 1.5, in this study the term "refurbishment" is defined as the "treatment or a modification of a product, or parts of a product, to increase or restore its performance and/or functionality or to meet applicable technical standards or regulatory requirements, with the result of making <u>a fully functional product to be used for a purpose that is at least the one that was originally intended</u>"[85]. The standard "BS8887-2:2009[86]" also provides a similar definition of refurbish / recondition, as process that aims to returns product to <u>satisfactory working conditions</u>.

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[85] Cordella et al., (2019) Improving material efficiency in the life cycle of products: a review of EU Ecolabel criteria. The International Journal of Life Cycle Assessment · March 2019. DOI: 10.1007/s11367-019-01608-8

[86]BS8887-2:2009 Design for manufacture, assembly, disassembly and end-of-life processing (MADE) Part 2: Terms and definitions

Remanufacture aims to return a used product to "at least" its original performance (Cordella et al. 2019; BS8887-2:2009) and, from customer viewpoint, <u>the remanufactured products can be considered to be the same as the new products</u>. It means that any subsequent warranty is generally at least equal to that of new products.

According to the Directive 2008/98/EC preparation for reuse is defined as "checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing".

According to the initial stakeholder feedback, second-hand IT equipment could be a procurement option in some scenarios (e.g. education). The analysis of voluntary approaches of manufacturers revealed that some manufacturers offer own refurbished products, see for example Apple's 'Certified Refurbished products'[87] which are based on full testing to meet the same functional standards as new products and have a one-year guarantee. This is also the case of Fairphone offers 'Refurbished Products' (Fairphone 2: New Life Edition)[88]. According to Fairphone, a factory-Refurbished product has undergone factory restoration and passed rigorous quality testing at Fairphone production facilities to ensure performance like new. Although the Refurbished Product might have minor physical marks, such as scratches or blemishes, it is guaranteed that the quality and performance will not be compromised; the refurbished product is also covered by the 2-year warranty. Samsung offers so called 'Certified Pre-Owned'[89] smartphones: Samsung engineers take the old devices apart, inspect them, replace damaged parts, reassemble them and update the software. Each device must pass more than 400 rigorous tests to make sure it's back to its original condition; each Samsung Certified Pre-Owned phone comes with a 12-month warranty, just like Samsung's new devices. The appliances are packaged with new charger and headphones. Regarding the software, Microsoft has launched the Microsoft Authorised Refurbisher (MAR) programme, a program tailored to the needs of large refurbishers minimum average threshold of 1,000 PCs shipped per month. Microsoft offers specially priced Microsoft licenses for refurbished computers with

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[87]

[88] https://www.fairphone.com/nl/2019/04/16/refurbished-phones-give-valuable-resources-a-new-life/

[89] https://www.samsung.com/us/explore/certified-pre-owned-phones/s/Device/

a previous Windows operating system Certificate of Authenticity (COA) or a Genuine Microsoft label affixed to the equipment[90].

Further, social enterprises are active in the refurbishment of ICT products. They already tend to source their products from public or private bodies. However, it very rarely goes the other way around. According to the experience of RREUSE members, it has been found that only two social enterprises (Promise IT[91] in Ireland and Atelier du Bocage[92] in France) did provide refurbished ICT to schools, but in the form of donations.

In cities and regions where such organisations exist, procuring from them or with manufacturers which developed partnerships with social enterprises could be a way to have both an environmental and social positive impact. Indeed, these structures provide jobs and training programmes to people at risk of socio-economic exclusion".

The initial criteria proposal (TS8 Refurbished Products), new compared to the existing 2016 GPP criteria for computers and monitors), aimed at a certain percentage of the equipment provided as part of the contract had to be refurbished products, and minimum requirements in terms of the quality for refurbished products should be set. As verification, the tenderer should provide details of the products refurbished, including confirmation of compliance with minimum technical performance for acceptance specified in the tender specifications. The verification of this criterion might benefit from labelling schemes on the quality of refurbished products.

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[90]http://download.microsoft.com/download/F/5/C/F5CCA956-A993-4ED6-B7B1-8BDBDAB3423F/MAR_Fact_Sheet_FY14Q3.pdf

[91] http://www.promiseit.ie/

[92] http://ateliers-du-bocage.fr/

Table 17:   **Initial criteria proposal TS8 Refurbished Products (GPP Technical Report Draft V1 November 2019)**

	New! TS8 Refurbished Products
	An X% of the equipment provided as part of the contract must be a refurbished products.
	Minimum requirements in terms of quality for refurbished products must be set (see the explanatory note for examples).
	Verification
	The tenderer must provide details of the products refurbished, including confirmation of compliance with minimum technical performance for acceptance specified in the tender specifications (see the explanatory note below).

Explanatory note: examples of requirements for refurbished ICT products
Operating status: in perfect working order and cleanliness
Aesthetic grade: micro scratches, invisible to more than 20cm
Battery state: new and compatible, with the same technical specifications of the original one
Accessories: New and compatible charger, USB cable, headphones.
Warranty: a minimum one year extended warranty services offered with the product

2.5.2 Further feedback and background after AHWG meeting and first stakeholder consultation

Several stakeholders generally supported the inclusion of this criterion, as the potential for refurbished products is very high and very promising in terms of resource savings and product lifetime extension. However, several challenges are highlighted:

1) whether or not a refurbished / remanufactured product should fulfil all the criteria (including the GPP criteria) of a new product;

2) how to ensure / verify that a minimum level of performance is achieved and the durability of the product;

3) whether or not the procurement of a refurbished / remanufactured product should be covered under a separate call for tender.

Regarding point 1), the proposal from JRC is to delete the criterion TS8 from the initial list of GPP criteria which are mainly targeted at the procurement of new equipment, and include a separate route for the procurement of refurbished or remanufactured ICT products describing which GPP criteria would be applicable for refurbished products and which Regulation(s) apply.

On point 2) above, according to some stakeholders the provision of a warranty is enough to guarantee the functionality of the product. The request of additional certifications could represent an unnecessary burden that will prevent the expansion of this market. From the other hand some remanufacturers consider that the quality of the process should be ensured by the application and compliance with standards as the BS 8887-220:2010. A Selection Criteria is p

Regarding point 3) it is proposed that the procurement of refurbished products should usually be covered under a specific tender not associated to the procurement of new products. In this way also small companies which are specified on refurbished products and do not have new products in their portfolio can take part.

Finally, stakeholders pointed out that refurbished products could be provided by social enterprises, with further social benefits. This aspect is now described in the report above, however social aspects are not in the scope of the EU GPP Criteria and the proposed criteria on refurbished products is based only on the *environmental* benefits.

2.5.3 Revised criteria proposal for the procurement of refurbished / remanufactured products

All GPP criteria listed the areas above where checked if they could or should be fulfilled also by refurbished ICT equipment.

For the requirements in **criteria area on Energy Consumption** (cf. section 2.1), for example one stakeholder highlighted that the Regulation 2017/1369 setting a framework on energy labelling explicitly says that "products that are made available on the Union market for a second or additional time should not be included [under the scope of the Regulation]". Further, the energy consumption in the use phase of ICT equipment is rather depending on the design of the initially new products which is rarely improvable without changing major components; however, doing so would mean additional resource consumption for integrating new components for improving the appliances' energy efficiency. As life-cycle assessments of computers show, the impact of the resource consumption due to manufacturing of computer components is rather higher than the impact of the energy consumption during the use phase. Finally, as the main target of procuring refurbished products is the extension of product lifetime of the products, the GPP criteria for refurbished products will not target their energy consumption.

For the requirements in **criteria area on Hazardous Substances** (cf. section 2.3), it has to be noted that for refurbished / remanufactured products, generally the legal provisions apply such as e.g. the RoHS requirements and the duty to communicate on the content of SVHC according to REACH Article 33.

If refurbished products contain the RoHS restricted substances beyond existing exemptions, then an own exemption must exist or has to be requested. This has been done e.g. for medical devices (RoHS Annex IV, exemption 31a).

As for GPP criteria going beyond the legal provisions, for this moment the GPP criteria for hazardous substances as described above should not apply for refurbished products. This is meant to support / promote refurbished products to come on the market. However, for the next revision of GPP criteria, it must be re-assessed whether then criteria on hazardous substances should apply.

For the requirements in **criteria area on Product Lifetime Extension**, the following criteria initially proposed for the procurement of new ICT equipment are with slight adaptions also applicable to refurbished ICT equipment:

- TS6a. Provision of an extended services agreement

- CPC1 Service Agreement (to be used in conjunction with the TS on Service Agreement)

- TS6b. Manufacturer's warranty (in this case refurbisherv/remanufacturer warranty)

- TS21. ICT Equipment without accessories

The following criteria, being Technical Specifications for the procurement of new ICT equipment, could rather be applicable as award criteria for refurbished products, as for example some most recent refurbished products are also available with standardized external power supply or detachable cables. For the reason of not generally favouring these most recent products in the procurement of refurbished ICT, it is recommended to change the following Technical Specification into award criteria:

- TS18. Standardized External Power Supply

- TS19. External Power Supply: Detachable Cables

Finally, the requirements on the quality of the battery of mobile ICT equipment are also relevant for refurbished ICT products.

- TS10. Rechargeable battery endurance

- TS11. Minimum requirements on the electrical performance

- AC5. Further rechargeable battery endurance

However, one stakeholder does not support the proposal in the initial Explanatory Note that batteries and accessories should always be new. These spare parts should only be replaced if non-functional or where they do not meet the criteria laid out here. The revised proposal is taking this argument into consideration by differentiating between refurbished products equipped with a new battery, where the above criteria should also apply. On the other hand, if the refurbished products still include the second-hand battery, the above quality criteria should not apply; however, in these cases, information about the quality of the battery should be given.

Finally, for the requirements in **criteria area on End-of-Life Management** (cf. section 2.4), the following criterion shall apply to refurbished products in case they are equipped with a new battery:

Core criteria	Comprehensive criteria

New! SC_R1 Quality of Refurbishment / Remanufacture Process

Applicable to the procurement of refurbished / remanufactured products To be included in a separate procurement route from brand new products

The tendered must ensure the implementation of quality assurance / quality control procedures covering as minimum the following steps:

- Inspection

- Reprocessing (e.g. repair / replace or upgrade) if needed

- Cleaning

- Testing

- Storage

- Packaging and Transport

Verification:

The tenderer must provide details of the quality assurance / quality control procedures established to ensure the quality of the equipment delivered as part of the contract (see the explanatory note below).

Third party certified refurbish/remanufactures management systems according to the following standards (or equivalent) can be accepted as proof of compliance:

- Quality and environmental management systems according to the ISO 9001 and ISO14001/EMAS, including quality assurance / quality control procedures for the steps mentioned above;

- BS 8887-220:2010 Design for manufacture, assembly, disassembly and end-of-life processing (MADE). The process of remanufacture. Specification (applicable to remanufacture processes);

- BS8887-240:2011 Design for manufacture, assembly, disassembly and end-of-life processing (MADE). Reconditioning (applicable to refurbished / reconditioned equipment);

- EN50614:2020 in case the equipment was previously discarded as WEEE, which has been prepared for re-use for the same purpose for which it was conceived

Explanatory note: quality assurance levels

The quality level required differs between refurbished/reconditioned products and remanufactured products. A remanufacturing process aims to restore the product to as new conditions, or better. A refurbishment / reconditioning aims to make the product fully functional to be used for a purpose that is at least the one that was originally intended.

The procurer should establish minimum quality requirements as for examples below:

- Aesthetic grade: no sign of aesthetic damages should be visible to more than 20 cm

- Original Factory Settings: The products must be restored to their original factory settings and must be fully unlocked for use.

- Products must be upgradeable to the latest firmware supported by the OEM (where applicable)

- An instruction manual must be provided. In the absence of physical instruction manuals, a link or reference to the manufacturer's instruction manual should be included, when possible.

TECHNICAL SPECIFICATIONS

	TS_R1(a). Provision of an extended services agreement The tenderer must provide a minimum of X years [*to be defined]* services as detailed in the Service Level Requirements document (see explanatory note below). **Verification**: The tenderer must provide a written declaration that the products supplied will be warrantied in conformity with the contract specifications and the related service level agreement.

EXPLANATORY NOTE: Examples of Service Level Requirements

A Service Level Requirements document describes how the service should be delivered to the customer. Examples of possible Service Level Requirements to be included are listed below:

- Access to the refurbisher/remanufacturer's warranty: register the warranty; manage any documentation or proof required to invoke the Warranty; invoke the Warranty on behalf of the Public Administration (during the Warranty's duration); follow up with the refurbisher in order to ensure that the terms of the Refurbisher Warranty are met;

- Pick up and return: pick-up the product(s) from a specified location at the Public Administration premises and return it/them to a specific location at the Public Administration premises.

- Management of failures: the provision of an efficient single point of contact for technical issues and problem escalations, a person responsible of following through the progress of the case, reporting, transparent access to a warranty database (whomever manages this warranty data) to verify warranty status, incident status for open incidents.

- Access to diagnostic and repair tools: access to all technical tools available to the tenderer to perform hardware diagnostics and corrections; access to any technical training required to become a certified repair technician; non-exclusivity to become a certified technical partner (perform warranty repairs).

- Battery coverage: the service explicitly covers battery defects for applicable products with rechargeable batteries as failure to charge or faulty battery connection. A progressive drop in battery capacity due to usage must not be considered to be a defect unless it is covered by the battery replacement policy of the bullet below.

- Battery replacement policy: the service covers replacing batteries not fulfilling the minimum performance conditions related to endurance in number of cycles (see TS on rechargeable batteries endurance)

- Provision of failure statistics provision of a high level, aggregate, anonymized and not traceable back statistics of incident types in nature and quantities, problems and diagnostics concerning the products in the scope of the contract

- Incident management / Problem management / Preventive maintenance: this service includes all the operations necessary to maintain the ICT products in perfect working order, or to restore a defective product or one of its components to perfect working order, including incident management, problem management and preventive maintenance. Preventive maintenance during the warranty period includes ensuring OS and security updates for the duration of the contract.

- Upgrading: a scan for upgrading possibilities can take place after a certain period (e.g. 3 years) and cover performance aspects like CPU/Memory/Disk.Repair / Replacement activities: repair or replace any products which become damaged or defective in the course of normal use during the Extended Warranty period with products which have identical or better performance characteristics. Breakdowns related to firmware are also covered. If part of an item is replaced, the replacement part must be covered by the same Extended Warranty level and duration as the replaced part. The Extended Warranty applies to both hardware and software, unless explicitly agreed otherwise

- Commitment to Repair / upgrade as first remedy in case of failures and, whenever technical feasible, the service provider commits to provide the option of a repair / upgrade of the equipment instead of an equipment substitution.

TS_R1(b) Refurbisher's warranty

The tenderer must provide products covered by X years [*at least 1 year for refurbished products, 2 years for remanufactured products, to be defined]* warranty.

Verification:

The tenderer must provide written evidence of the warranty.

TS_R2(a). Rechargeable battery endurance	**TS_R2(a). Rechargeable battery endurance**
Applicable to refurbished mobile equipment (laptops / tablets and smartphones) equipped with a _new_ battery:	*Applicable to refurbished mobile equipment (laptops / tablets and smartphones) equipped with a _new_ battery:*
The battery endurance must be greater than 300 battery cycles (with SoC ≥80%).	- The battery endurance must be: greater than 500 cycles (with SoC ≥80%), or - The battery endurance must be: greater than 300 cycles (with SoC ≥90%)
Tests must be carried out according to the standard IEC EN 61960-3:2017 at 20 ± 5°C and at a rate of 0.5 It A (accelerated test procedure)	Tests must be carried out according to the standard IEC EN 61960-3:2017 at 20 ± 5°C and at a rate of 0.5 It A (accelerated test procedure).
Verification:	**Verification**:
Tenderers must provide test results obtained by accredited ISO17025 test bodies according to the IEC EN 61960-3:2017 standard.	Tenderers must provide test results obtained by accredited ISO17025 test bodies according to the IEC EN 61960-3:2017 standard.
Equipment holding the following Type I Eco-labels will be deemed to comply:	

In particular holding one the following labels is considered as proof of compliance:	Equipment holding the following Type I Eco-labels will be deemed to comply:
- Blue Angel for Computers and Keyboards (DE-UZ 78 (2017)) - TCO Certified Generation 8 certificate that shows compliance with 80% capacity retention - Nordic Ecolabelling Version 5.0 for rechargeable batteries and portable chargers (2018)	- TCO Certified Generation 8 certificate that shows compliance with 90% capacity retention - Blue Angel for Computers and Keyboards (DE-UZ 78 (2017))

TS_R2(b). Information on the rechargeable battery endurance

Applicable to refurbished mobile equipment (laptops / tablets and smartphones) equipped with a <u>second-hand</u> battery:

The tenderer must indicate minimum levels of the second-hand battery state of health (SoH) in the tender (e.g. SoH > 80%).

Verification:

Tenderers must provide information on the battery SoH for the mobile equipment shipped as part of the contract.

	TS_R3. Minimum requirements on the electrical performance
	Applicable to refurbished mobile equipment (laptops / tablets and smartphones) equipped with a <u>new</u> battery:
	The battery must be compliant with the electrical test criteria according to standard IEC EN 61960-3:2017.
	Verification:
	Tenderers must provide test results obtained by accredited ISO17025 test bodies.
	Products holding a relevant Type I Eco-label fulfilling this specified requirement will be deemed to comply.

AWARD CRITERIA	

	AC_R1. Further rechargeable battery endurance
	Applicable to refurbished mobile equipment (laptops / tablets and smartphones) equipped with a <u>new</u> battery:
	Additional points will be awarded if the battery endurance is granter than 500 cycles (with ≥80% capacity retention of the initial rated capacity) proportionally to the additional number of cycles ensured.
	Verification:
	Tests must be carried out according to the standard IEC EN 61960-3:2017 at 20 ± 5oC and at a rate of 0.5 It A (accelerated test procedure) Tenderers must

	provide test results obtained by accredited ISO17025 test bodies.
	AC_R2. Standardized External Power Supply
	Applicable to portable computing devices with power supplies up to 100 W.
	This is not applicable to products with only Qi charging capability (e.g. for strong resistance to immersion into water or to dust, such as industrial computers).
	Additional points will be awarded if the equipment delivered as part of the contract carries a USB Type C standardized receptacle for power delivery (PD) according to the standard EN/IEC 63002:2017.
	If the product does not have a built-in USB PD receptacle, then an adapter must accompany the product when it is delivered to the end user.
	Verification:
	The tenderer must provide a product manual for each model provided, which must include an exploded diagram of the device illustrating the types of receptacle used for power delivery.

EXPLANATORY NOTE: Standardized External Power Supply

Interoperability guidelines for external power supplies are defined according to the IEC 63002:2016 - Identification and communication interoperability method for external power supplies used with portable computing devices.

	AC_R3. External Power Supply: Detachable Cables
	Additional points will be awarded if the External Power Supply (EPS) configuration consists of an EPS with a detachable input cable (or integrated in the EPS housing) and a detachable output cable to the ICT device
	Verification:
	The tenderer must provide a product manual for each model provided, which must include an exploded diagram of the device illustrating the types of EPS used.

CONTRACT PERFORMANCE CLAUSE

	CPC_R1 Service Agreement
	To be used in conjunction with the TS_R1a on Service Agreement
	The tenderer must provide periodical [*monthly / annually*] reporting on its compliance with all the metrics, Key Performance Indicators and other indicators defined by the Service Level Agreement

EXPLANATORY NOTE: Examples of Key Performance Indicators (KPIs)

- Aggregate KPI 1 – Incident solved: number of incidents resolved within the incident resolution time during a month / total number of incidents opened during the given month or opened during a previous month and still pending. Monthly target: ≥90%.

- Aggregate KPI 2 – Commitment to repair as first remedy: number of incidents resolved within a product repair or upgrade / number of incidents resolved within a product replacement.

3 Guidance: criteria applicability and priorities for the different product groups in scope

Some stakeholders providing feedback at the AHWG meeting and the following stakeholder consultation asked JRC to provide better guidance and orientation for procurers on the most relevant criteria among the long list of GPP criteria in the four areas on energy consumption, hazardous substances, product lifetime extension, and end-of-life management.

Following this proposal, in a first step the long list of GPP criteria has been filtered to show which of the criteria are applicable to the respective subgroups of the ICT devices in scope.

3.1 Applicability of criteria for the different product groups in scope

3.1.1 Stationary ICT devices (computers, computer displays)

3.1.1.1 Stationary computers

Table 18 shows the GPP criteria being applicable to stationary computers, i.e. desktop computers, all-in-one computers or integrated desktop computers, desktop thin clients and workstations. Focus is on product lifetime extension through an extended services agreement and/or manufacturer's warranty, design for reparability and continued availability of spare parts as well as interoperability and reusability of components (standardized ports, detachable cables, adapters). Another focus is on facilitating the end-of-life management through improved recyclability of the appliances.

Table 18: GPP criteria applicable for stationary computers (Desktop computers, all-in-one computers or integrated desktop computers, desktop thin clients and workstations)

Criteria area	Criteria Level: Core	Criteria Level: Comprehensive	Kind of GPP criteria
Product lifetime extension	TS6a. Provision of an extended services agreement		Technical Specification
Product lifetime extension	TS6b. Manufacturer's warranty		Technical Specification
Product lifetime extension	TS7a. Continued availability of spare parts		Technical Specification
Product lifetime extension	TS7b. Design for reparability	TS7b. Design for reparability	Technical Specification
Product lifetime extension	TS9. Functionality for secure data deletion		Technical Specification
Product lifetime extension	CPC1 Service Agreement (to be used in conjunction with the TS6a)		Contract Performance Clause
Product lifetime extension	TS17. Standardized port		Technical Specification
Product lifetime extension	---	TS19. External Power Supply: Detachable Cables	Technical Specification
Product lifetime extension	---	TS20. Backward compatibility: adapters	Technical Specification
Product lifetime extension	---	TS21. ICT Equipment without accessories	Technical Specification
Energy Consumption	TS1. Minimum Energy performance for computers	TS1. Minimum Energy performance for computers	Technical Specification
Energy Consumption	---	TS3. Thin Client devices in a server based environment	Technical Specification
Energy Consumption	AC1. Improvement in the energy consumption upon the specified Energy consumption threshold for computers	AC1. Improvement in the energy consumption upon the specified Energy consumption threshold for computers	Award Criterion
Hazardous substances	SC1. Substance controls		Selection Criterion
Hazardous substances	TS5. Restriction of halogenated substances in plastic parts		Technical Specification
Hazardous substances	---	AC3. Restriction of Substances of Very High Concern	Award Criterion
Hazardous substances	---	AC4. Avoidance of regrettable substitution	Award Criterion
End-of-life management	---	TS23a. Recyclability of plastics casings, enclosures and bezels	Technical Specification
End-of-life management	---	TS23b. Recyclability of plastics casings, enclosures and bezels	Technical Specification
End-of-life management	---	TS24. Plastic composition recyclability	Technical Specification
End-of-life management		TS25. Marking of plastic casings, enclosures and bezels	Technical Specification
End-of-life management	TS28. Secure computer collection, sanitisation, re-use and recycling		Technical Specification
End-of-life management	CPC3. Reporting on the end-destination of ICT equipment		Contract Performance Clause

Not applied to stationary computers are the specific energy criteria for displays (TS2, AC2), the requirements regarding batteries (TS10 to TS13, TS26, AC5) and durability testing (TS14 to TS16, AC6, AC7) and standardised external power supply (TS18).

3.1.1.2 Computer displays

Table 19 shows the GPP criteria being applicable to computer displays. Focus is on product lifetime extension through an extended services agreement and/or manufacturer's warranty, design for reparability and continued availability of spare parts. Another focus is on facilitating the end-of-life management through improved recyclability of the appliances.

Table 19: GPP criteria applicable for computer displays

Criteria area	Criteria Level: Core	Criteria Level: Comprehensive	Kind of GPP criteria
Product lifetime extension	TS6a. Provision of an extended services agreement		Technical Specification
Product lifetime extension	TS6b. Manufacturer's warranty		Technical Specification
Product lifetime extension	TS7a. Continued availability of spare parts		Technical Specification
Product lifetime extension	TS7b. Design for reparability	TS7b. Design for reparability	Technical Specification
Product lifetime extension	CPC1 Service Agreement (to be used in conjunction with the TS6a)		Contract Performance Clause
Product lifetime extension	---	TS21. ICT Equipment without accessories	Technical Specification
Energy	TS2. Minimum Energy performance of monitors	TS2. Minimum Energy performance of monitors	Technical Specification
Energy	AC2. Improvement in the energy consumption upon the specified Energy consumption threshold for monitors	AC2. Improvement in the energy consumption upon the specified Energy consumption threshold for monitors	Award Criterion
Hazardous substances	SC1. Substance controls		Selection Criterion
Hazardous substances	TS5. Restriction of halogenated substances in plastic parts		Technical Specification
Hazardous substances	---	AC3. Restriction of Substances of Very High Concern	Award Criterion
Hazardous substances	---	AC4. Avoidance of regrettable substitution	Award Criterion
End-of-life management	---	TS23a. Recyclability of plastics casings, enclosures and bezels	Technical Specification
End-of-life management	---	TS23b. Recyclability of plastics casings, enclosures and bezels	Technical Specification
End-of-life management	---	TS24. Plastic composition recyclability	Technical Specification
End-of-life management		TS25. Marking of plastic casings, enclosures and bezels	Technical Specification
End-of-life management	TS28. Secure computer collection, sanitisation, re-use and recycling		Technical Specification
End-of-life management	CPC3. Reporting on the end-destination of ICT equipment		Contract Performance Clause

Not applied to computer displays are the specific energy criteria for computers (TS1, TS3, AC1), the requirements regarding batteries (TS10 to TS13, TS26, AC5) and durability testing (TS14 to TS16, AC6, AC7), most criteria on interoperability and reusability of components (TS17 to TS20) and functionality for secure data deletion (TS9).

3.1.2 Mobile ICT devices (portable computers, tablets, smartphones)

3.1.2.1 Portable computers (notebooks, two-in-one notebooks, mobile thin clients)

Table 20 shows the GPP criteria being applicable to mobile computers, i.e. notebooks, two-in-one notebooks and mobile thin clients. To increase the overall product lifetime of the portable computers, focus is on several quality requirements for the rechargeable battery and the battery's state of health. Further focus is on the durability testing of the mobile computers. Also, the extended services agreement and/or manufacturer's warranty, design for reparability and continued availability of spare parts as well as interoperability and reusability of components (standardized ports, detachable cables, adapters) apply. For portable computers, also facilitating the end-of-life management through improved recyclability of the appliances is possible.

Table 20: GPP criteria applicable for portable computers (notebooks, two-in-one notebooks, mobile thin clients)

Criteria area	Criteria Level: Core	Criteria Level: Comprehensive	Kind of GPP criteria
Product lifetime extension	TS6a. Provision of an extended services agreement		Technical Specification
Product lifetime extension	TS6b. Manufacturer's warranty		Technical Specification
Product lifetime extension	TS7a. Continued availability of spare parts		Technical Specification
Product lifetime extension	TS7b. Design for reparability	TS7b. Design for reparability	Technical Specification
Product lifetime extension	TS9. Functionality for secure data deletion		Technical Specification
Product lifetime extension	CPC1 Service Agreement (to be used in conjunction with the TS6a)		Contract Performance Clause
Product lifetime extension	TS10. Rechargeable battery endurance	TS10. Rechargeable battery endurance	Technical Specification
Product lifetime extension	---	TS11. Minimum requirements on the electrical performance	Technical Specification
Product lifetime extension	TS12. Information on battery state of health		Technical Specification
Product lifetime extension	TS13. Battery protection software	TS13. Battery protection software	Technical Specification
Product lifetime extension	---	AC5. Further rechargeable battery endurance	Award Criterion
Product lifetime extension	TS14. Drop testing		Technical Specification
Product lifetime extension	---	TS15. Temperature stress	Technical Specification
Product lifetime extension	---	TS16. Ingress protection level	Technical Specification
Product lifetime extension	AC6. Mobile equipment durability testing		Award Criterion
Product lifetime extension	AC7. Ingress protection level - Semi rugged / rugged devices		Award Criterion
Product lifetime extension	TS17. Standardized port		Technical Specification
Product lifetime extension	---	TS18. Standardized External Power Supply	Technical Specification
Product lifetime extension	---	TS19. External Power Supply: Detachable Cables	Technical Specification
Product lifetime extension	---	TS20. Backward compatibility: adapters	Technical Specification
Product lifetime extension	---	TS21. ICT Equipment without accessories	Technical Specification
Energy Consumption	TS1. Minimum Energy performance for computers	TS1. Minimum Energy performance for computers	Technical Specification
Energy Consumption	---	TS3. Thin Client devices in a server based environment	Technical Specification
Energy Consumption	AC1. Improvement in the energy consumption upon the specified Energy consumption threshold for computers	AC1. Improvement in the energy consumption upon the specified Energy consumption threshold for computers	Award Criterion
Hazardous substances	SC1. Substance controls		Selection Criterion
Hazardous substances	TS5. Restriction of halogenated substances in plastic parts		Technical Specification
Hazardous substances	---	AC3. Restriction of Substances of Very High Concern	Award Criterion
Hazardous substances	---	AC4. Avoidance of regrettable substitution	Award Criterion
End-of-life management	TS28. Secure computer collection, sanitisation, re-use and recycling		Technical Specification
End-of-life management	CPC3. Reporting on the end-destination of ICT equipment		Contract Performance Clause

The only criteria not applicable to mobile computers are the specific energy criteria for separate displays (TS2, AC2) and the criteria for recyclability of plastic casing (TS23a, TS23b, TS24 and TS25) that are proposed to be limited to the procurement of desktop computers and displays.

3.1.2.2 Tablet computers and smartphones

Table 21 shows the GPP criteria being applicable to tablet computers and smartphones. In general, they are the same as for mobile computers (notebooks, two-in-one notebooks and mobile thin clients), with a focus on increasing the overall product lifetime through several quality requirements for the rechargeable battery and the battery's state of health as well as durability testing. Also, the extended services agreement and/or manufacturer's warranty, design for reparability and continued availability of spare parts as well as interoperability and reusability of components (standardized ports, detachable cables, adapters) apply. For portable computers, also facilitating the end-of-life management through improved recyclability of the appliances is possible. For tablet computers and smartphones, no GPP criteria on

energy consumption are applied at all as the efficiency of these devices is less relevant and already optimized for these small mobile devices.

Table 21: GPP criteria applicable for tablet computers and smartphones

Criteria area	Criteria Level: Core	Criteria Level: Comprehensive	Kind of GPP criteria
Product lifetime extension	TS6a. Provision of an extended services agreement		Technical Specification
Product lifetime extension	TS6b. Manufacturer's warranty		Technical Specification
Product lifetime extension	TS7a. Continued availability of spare parts		Technical Specification
Product lifetime extension	TS7b. Design for reparability	TS7b. Design for reparability	Technical Specification
Product lifetime extension	TS9. Functionality for secure data deletion		Technical Specification
Product lifetime extension	CPC1 Service Agreement (to be used in conjunction with the TS6a)		Contract Performance Clause
Product lifetime extension	TS10. Rechargeable battery endurance	TS10. Rechargeable battery endurance	Technical Specification
Product lifetime extension	---	TS11. Minimum requirements on the electrical performance	Technical Specification
Product lifetime extension	TS12. Information on battery state of health		Technical Specification
Product lifetime extension	TS13. Battery protection software	TS13. Battery protection software	Technical Specification
Product lifetime extension	---	AC5. Further rechargeable battery endurance	Award Criterion
Product lifetime extension	TS14. Drop testing		Technical Specification
Product lifetime extension	---	TS15. Temperature stress	Technical Specification
Product lifetime extension	---	TS16. Ingress protection level	Technical Specification
Product lifetime extension	AC6. Mobile equipment durability testing		Award Criterion
Product lifetime extension	AC7. Ingress protection level - Semi rugged / rugged devices		Award Criterion
Product lifetime extension	TS17. Standardized port		Technical Specification
Product lifetime extension	---	TS18. Standardized External Power Supply	Technical Specification
Product lifetime extension	---	TS19. External Power Supply: Detachable Cables	Technical Specification
Product lifetime extension	---	TS20. Backward compatibility: adapters	Technical Specification
Product lifetime extension	---	TS21. ICT Equipment without accessories	Technical Specification
Hazardous substances	SC1. Substance controls		Selection Criterion
Hazardous substances	TS5. Restriction of halogenated substances in plastic parts		Technical Specification
Hazardous substances	---	AC3. Restriction of Substances of Very High Concern	Award Criterion
Hazardous substances	---	AC4. Avoidance of regrettable substitution	Award Criterion
End-of-life management	TS28. Secure computer collection, sanitisation, re-use and recycling		Technical Specification
End-of-life management	CPC3. Reporting on the end-destination of ICT equipment		Contract Performance Clause

3.2 Use of labels as means of proof

According to the Article 43 of the Procurement Directive[93], where contracting authorities intend to purchase works, supplies or services with specific environmental, social or other characteristics they may require a specific label **as means of proof** that the works, services or supplies correspond to the required characteristics. These labels must fulfil the conditions (a-e) of the Article 43. It is important to note that contracting authorities requiring a specific label shall accept all labels that confirm that the works, supplies or services meet equivalent label requirements as specified in the same Article 43.

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[93] Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement

Table 22,

Table 23Table 24 andTable 25 include a non-exhaustive list of labels applicable as means of proof for the EU GPP Criteria. Ideally, the use of these labels as means of proof should reduce the verification burdens for public authorities. This table is based on the analysis of labels performed as part of the Preliminary Report to this study. Where labels able to ensure the fulfilment of the criteria are not identified, test reports or other documents can still be used as proof of compliance as describe in the text of the proposed criteria.

It should be noted that at the time of the publication of this report (June 2020) only ENERGY STAR, TCO Certified and EPEAT have a relevant number of products labelled/registered, with a quite limited amount of labelled products under the categories "Tablets" and "Smartphones". Moreover the EU Ecolabel for Displays is under finalisation and, once approved, could also be used as mean of proof for some of the criteria applicable to displays.

The availability of labelled products can be verified directly through the product finder tools available at the following websites:

- Energy Star: https://www.energystar.gov/productfinder/
- TCO Certified: https://tcocertified.com/product-finder
- EPEAT https://epeat.net/
- BLUE Angel https://www.blauer-engel.de/en/products/electric-devices/computers-and-keyboards
- Nordic Swan: https://www.svanen.se/en/search-for-ecolabelled-products-and-services/?productgroup=030

This applicability analysis is limited to the current version of the labels at the time of drafting of this report, as specified in the verification requirements of each criterion and in particular:

- TCO Certified Generation 8
- EPEAT Computers and Displays Category criteria [based on IEEE 1680.1™ – 2018 Standard for Environmental and Social Responsibility Assessment of Computers and Displays[94]

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[94] An amendment for Editorial and Technical Corrections and Clarifications was published in 2020: EPEAT Computers and Displays Category criteria [based on 1680.1a-2020 – IEEE Standard for Environmental and Social Responsibility Assessment of Computers and Displays–Amendment 1: Editorial and Technical Corrections and Clarifications]

- EPEAT Mobile Phones [based on theUL 110 Standard for Sustainability for Mobile Phones (Second Edition, Dated March 24, 2017 (including revisions through September 28, 2018))63
- Blue Angel Computer and Keyboards (DE-UZ 78)
- Blue Angel for Mobile Phones (DE-UZ 106)
- Nordic Swan Ecolabel for rechargeable batteries and portable chargers Version 5.0

Table 22: Applicability of labels as means of proof for the Energy Efficiency Criteria

Criterion	Desktop Computer		Notebook Computers		Smartphones and Tablets		Computer Monitors	
	Core	Comp	Core	Comp	Core	Comp	Core	Comp
PRODUCT LIFETIME EXTENSION								
TS6a Provision of an extended services agreement	Service Contract							
CPC1 Service Agreement	Service Contract							
TS6b Manufacturer's warranty	Manufacturer Warranty							
T7a Continued availability of spare parts	Service Contract							
T7b Design for reparability	[TCO logo]	Service Manual	[TCO logo]	Service Manual	[TCO logo]	Service Manual	[TCO logo]	Service Manual
TS9 Functionality for secure data deletion	[TCO logo]		[TCO logo]		[TCO logo]		Not applicable	
TS10 Rechargeable battery endurance	Not applicable		[TCO logo] [logos] Note 6	[TCO logo] [logo] Note 7	[TCO logo] [logos] Note 6	[TCO logo] [logo] Note 7	Not applicable	
TS11 Minimum requirements on the electrical performance	Not applicable		IEC 61960-3 Test Report				Not applicable	
TS12 Information on battery state of health	Not applicable		[logo]		Not applicable	Software specifications	Not applicable	
TS13 Battery protection software	Not applicable		[logo]		Not applicable	Software specifications	Not applicable	
AC5 Further rechargeable battery endurance	Not applicable		IEC 61960-3 Test Report				Not applicable	
TS14 Drop testing	Not applicable		[TCO logo]		[TCO logo]		Not applicable	
TS15 Temperature Stress	Not applicable		[TCO logo]		[TCO logo]		Not applicable	
TS16 Ingress protection level	Not applicable		IEC/EN 60529:2013 or MIL STD 510.5, Procedure I Sand and dust - Blowing dust and MIL-STD-810G, Method 506.5 (Procedure I Rain and blowing rain)				Not applicable	
AC6 Mobile equipment durability testing	Not applicable		IEC 60068, US MIL810G				Not applicable	
AC7 Ingress Protection Level – Semi Rugged and Rugged Devices	Not applicable		IEC/EN 60529:2013				Not applicable	
TS17 Standardized connectors	[TCO logo]						Not applicable	
TS18 Standardized External Power Supply	Not applicable		Not applicable	EN/IEC 63002:2017	Not applicable	Product Specifications	Not applicable	
TS19 External Power Supply: Detachable Cables	Not applicable		Not applicable	Product Specifications	Not applicable	Product Specifications	Not applicable	
TS20 Backward compatibility: adapters	Not applicable		Not applicable	Product Specifications	Not applicable	Product Specifications	Not applicable	
TS21 ICT Equipment without accessories	Not applicable		Not applicable	Product Specifications	Not applicable	Product Specifications	Not applicable	
Note 6: TCO Certified Generation 8 is acceptable if the certificate shows compliance with 80% retention								
Note 7: TCO Certified Generation 8 is acceptable if the certificate shows compliance with 90% retention								

Table 23: Applicability of labels as means of proof for the Hazardous Substances Criteria

Criterion	Desktop Computer		Notebook Computers		Smartphones and Tablets		Computer Monitors	
	Core	Comp	Core	Comp	Core	Comp	Core	Comp
HAZARDOUS SUBSTANCES								
SC1 Substance controls	IEC 62476 / IEC 62474 or IPC1752							
TS5. Restriction of halogenated substances in plastic parts	Note 3							
AC3 Restriction of Substances of Very High Concern	Not Applicable	Note 4	Not Applicable				Not Applicable	Note 4
AC4 Avoidance of Regrattable Substitutions	Not Applicable	Note 5	Not Applicable				Not Applicable	Note 5
Note 3: in case of smartphones the optional criterion 9.2.3 Restriction of Bromine must be fulfilled								
Note 4: in case of using EPEAT the device must fulfill the optional criterion 4.1.6.2								
Note 5: in case of using EPEAT the device must fulfill the optional criterion 4.1.8.1								

Table 24: Applicability of labels as means of proof for the Product Lifetime Extension Criteria

Criterion	Desktop Computer		Notebook Computers		Smartphones and Tablets		Computer Monitors	
	Core	Comp	Core	Comp	Core	Comp	Core	Comp
ENERGY EFFICIENCY								
TS1 Minimum Energy performance for computers	See note 1	See note 2	See note 1	See note 2	Not Applicable			
TS2 Minimum Energy Performance of Monitors	Not Applicable						CLASS D	CLASS C
TS3 Thin Client devices in a server based environment	Not Applicable		Not Applicable					
AC1 Improvement in the energy consumption upon the specified Energy consumption threshold for	Not Applicable		Not Applicable					
AC2 Improvement in the energy consumption upon the specified Energy Consumption threshold for monitors	Not Applicable						CLASS A-C	CLASS A-B
Note 1: Energy Star Version 6.1 or following versions								
Note 2: Energy Star Version 7.0, 7.1 or 8.0 ; TCO Certified Generation 8 only in case the certificate show compliance with the thesholds applied by Energy Star version 7.0, 7.1 or 8								

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Table 25: Applicability of labels as means of proof for the End of Life Criteria

Criterion	Desktop Computers		Notebook Computers		Smartphones and Tablets		Computer Monitors	
	Core	Comp	Core	Compe	Core	Comp	Core	Comp
END OF LIFE								
TS23a Recyclability of plastics casings, enclosures and bezels (a)	Not applicable		Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	
TS23b Recyclability of plastics casings, enclosures and bezels (b)	Not applicable		Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	
TS24 Plastic composition recyclability	Not applicable		Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	
TS25 TS25. Marking of plastic casings, enclosures and bezels	Not applicable		Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	
TS28 Secure computer collection, sanitisation, re-use and recycling	Service Contract							
CP3 Reporting on the end-destination of ICT equipment	Service Contract							

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ANNEX I: Battery testing according to the EC EN 61960-3:2017

Parameter	Description	Acceptance Criteria Battery
Discharge performance at 20 °C (Rated Capacity)	This test verifies the rated capacity of the battery.	100% of the rated capacity (C5 Ah)[95]
Discharge performance at −20 °C (Rated Capacity)	This test determines the capacity of the battery at low temperatures	30% of the rated capacity (C5 Ah)
High rate discharge performance at 20 C	This test determines the capacity of the battery when discharged at high rate. This test is not required if the battery is not designed to be used at this rate (1 ItA)	60% of the rated capacity (C5 Ah)
Charge (capacity) retention and recovery	This test determines firstly the capacity which a battery retain after a storage for an extended period of time (28 days) and secondly the capacity that can be recovered by a subsequent recharge.	60% of the rated capacity (C5 Ah)
Charge (capacity) retention after long term storage	This test determines the capacity of a battery after extended storage (90 days) at 50% state of charge, followed by a subsequent charge	85% of the rated capacity (C5 Ah)
Endurance in cycles	This test determines the number of charge/discharge cycles which a battery can endure before its capacity has been significantly depleted.	60% of the rated capacity (C5 Ah) after 300 cycles
Electrostatic discharge	This test is to evaluate the ability of a battery to with stand electrostatic discharge.	Operational

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[95] Amount of electricity declared by the manufacturer that a cell can deliver in a 5 hours period

ANNEX II: Durability tests for mobile equipment

Test	Test method	Minimum thresholds		Functional performance requirements
Accidental drop	IEC 60068 Part 2-31: Ec (Freefall, procedure 1) OR MIL-STD-810G w/CHANGE 1 Drop test: Method 516.7 - Shock (procedure IV)	CORE CRITERIA The notebook or tablet must be dropped from: a minimum of 45 cm (modified drop test height) of height onto a non-yielding surface. A minimum of one drop must be made on each bottom side and each bottom corner:	AWARD CRITERIA The notebook or tablet must be dropped from: a minimum of 76 cm (30 inches[96]) of height onto a non-yielding surface. A minimum of one drop must be made on each bottom side and each bottom corner.	After exposure to any of the specified stress tests, the product should be able to: 1. Boot up and operate normally • Boot or resume should not exceed 50% greater time increase as a result of the test. • No noticeable operational faults when using standard software applications • No major damage to the product that does not allow for standard usage. 2. Not create hazards to end user • No case or display cracking or other sharp points created from failures that could injure a user. • No electrical component failures or access that could result in a user safety issue.
Temperature stress	IEC 60068 Part 2-1: A Cold Part 2-2: B Dry Heat OR MIL-STD-810G w/CHANGE 1 High temperature: Method 501.6 - Basic Hot (A2) Low temperature: Method 502.6 - Basic Cold (C1)	The mobile equipment must be subjected to test cycles of a minimum of 48 hour exposure for storage temperature at: • High temperature Storage ≥ 60 ° C • Low temperature Storage ≤ -30 ° C The mobile equipment must be subjected to test cycles of a minimum of 4 hour for operational temperature at: • Operational temperature ≥ 40 ° C • Operational temperature ≤ -20 ° C		
Screen resilience	The test equipment and setup used must be confirmed by the tenderer. Applicable test standards include:		With the product placed on a flat surface two loading tests must be carried out: A minimum load of 50kg must be evenly applied to the screen lid (for notebooks) or screen (for tablets).	

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[96] US Department of Defence standard MIL-STD-810G Method 516.6 Specification VI 'Transit drop test'

Test	Test method	Minimum thresholds		Functional performance requirements
	ISO 1518-1:2019 Paints and varnishes — Determination of scratch resistance — Part 1: Constant-loading method ISO 1518-:2019 Paints and varnishes — Determination of scratch resistance — Part 2: Variable-loading method ASTM C1895 – 19 using a hardness test pencil equipped with a spiral spring and a carbide ball tip of 1 mm diameter (in accordance with ISO 1518),		A minimum load of 25kg must be applied to a point at the centre of screen with a diameter of approximately 3cm.	
Resistance to shock	IEC 60068 Part 2-27: Test Ea and guidance: Shock Part 2-47 Test - Mounting of specimens for vibration, impact and similar dynamic tests		A minimum of a 40G peak half-sine wave pulse must be applied three times for a duration of a minimum of 6 ms to the top, bottom, right, left, front and rear side of the product.	
Resistance to vibration	IEC 60068 Part 2-6: Test Fc: Vibration (sinusoidal) Part 2-47 Test - Mounting of specimens for vibration, impact and similar dynamic tests		Minimum specification: Randomised sinusoidal vibrations in the frequency range 5Hz up to a minimum of 250Hz must be applied for a minimum of 1 sweep cycle to the end of each axis of the top, bottom, right, left, front and back of the product.	
Dust ingress protection	IEC 60529, Degree of Protection provided by Enclosures		IP-6x - No ingress of dust; complete protection against contact;	

Test	Test method	Minimum thresholds		Functional performance requirements
	or MIL-STD-810G Method 510.5, Procedure I Sand and dust - Blowing dust			
Water Ingress Protection	IEC 60529, Degree of Protection provided by Enclosures MIL-STD-810G, Method 506.5 Procedure I Rain and blowing rain		IP-x5 - Water is projected in jets against the enclosure from any direction with no harmful effects;	

ANNEX III: Minimum Energy performance for computers (based on Energy Star for Computers, Specifications 7.1)

Calculated Typical Energy Consumption (E_{TEC}) for Desktop, Integrated Desktop, and Notebook Computers per shall be less than or equal to the maximum TEC (E_{TEC_MAX}) as calculated below:

(E_{TEC_MAX}) per Equation below:

$$E_{TEC\_MAX} = (1+ALLOWANCE_{PSU}) \times (TEC_{BASE} + TEC_{MEMORY} + TEC_{GRAPHICS} + TEC_{STORAGE} + TEC_{INT\_DISPLAY} + TEC_{SWITCHABLE} + TEC_{EEE} + TEC_{MOBILEWORKSTATIONS})$$

Where:

- $ALLOWANCE_{PSU}$ is an allowance provided to power supplies that meet the optional more stringent efficiency levels specified in **Error! Reference source not found.**; power supplies that do not meet the requirements receive an allowance of 0;
- TEC_{BASE} is the Base allowance specified in Table 27; and,
- $TEC_{GRAPHICS}$ is the discrete graphics allowance as specified in **Error! Reference source not found.**, with the exception of systems with integrated graphics, which do not receive an allowance, or Desktops and Integrated Desktops with switchable graphics enabled by default, which receive an allowance through $TEC_{SWITCHABLE}$; and
- TEC_{MEMORY}, $TEC_{STORAGE}$, $TEC_{INT\_DISPLAY}$, $TEC_{SWITCHABLE}$, TEC_{EEE} and $TEC_{MOBILEWORKSTATIONS}$ are adder allowances as specified in Table 28

Table 26:   Power Supply Efficiency Allowance

Power Supply Type	Computer Type	Minimum Efficiency at Specified Proportion of Rated Output Current				Minimum Average Efficiency	Allowance$_{PSU}$
		10%	20%	50%	100%		
IPS	Desktop	0.86	0.90	0.92	0.89	-	0.015
		0.90	0.92	0.94	0.90	-	0.03
	Integrated Desktop	0.86	0.90	0.92	0.89	-	0.015
		0.90	0.92	0.94	0.90	-	0.04

Table 27: Base TEC (TEC$_{BASE}$) Allowances for Desktop or Integrated Desktops and Notebooks

Category Name	Graphic Capability	Desktop or Integrated Desktop	
		Performance Score, P	Base Allowance
0	Any Graphics dGfx≤G7	P≤3	69.0
I1	Integrated or Switchable Graphics	3<P≤6	112.0
I2		6<P≤7	120.0
I3		P>7	135.0
D1	Discrete Graphics dGfx≤G7	3<P≤9	115.0
D2		P>9	135.0
Category Name		**Notebooks**	
		Performance Score, PV	Base Allowance
0		P≤2	6.5
I1		2<P≤5.2	22.0
I2		5.2<P≤8	8.0
I3		P>8	14.0

Table 28: **Functional Adder Allowances for Desktop, Integrated Desktop, Thin Client and Notebooks Computers**

Function			Desktop	Integrated Desktop	Notebook
TEC$_{MEMORY}$ (kWh) vi			0.8		2.4 + (0.294 x GB)
TEC$_{GRAPHICS}$ (kWh) vii	Graphics Category Viii	G1 (FB_BW ≤ 16)	36		29.3 x tanh (0.0038 x FB_BW − 0.137) + 13.4
		G2 (16< FB_BW ≤ 32)	51		
		G3 (32 < FB_BW ≤ 64)	64		
		G4 (64 < FB_BW ≤ 96)	83		
		G5 (96 < FB_BW ≤ 128)	105		
		G6 (FB_BW > 128; Frame Buffer Data Width < 192 bits)	115		
		G7 (FB_BW > 128; Frame Buffer Data Width ≥ 192 bits	130		
TEC$_{SWITCHABLE}$ (kWh)			0.5 x G1		N/A
TEC$_{EEE}$ (kWh) x			8.76 x 0.2 x (0.15 + 0.35)		8.76 x 0.2 x (0.10 + 0.30)
TEC$_{STORAGE}$ (kWh) xi			26		2.6
TEC$_{INT\_DISPLAY}$ (kWh) xii			N/A	8.76 x 0.35 x (1+EP) x (4xr +0.05 x A)	8.76 x 0.30 x (1+EP) x (2 x r +0.02 x A)
TEC$_{MOBILEWORKSTATION}$ (kWh) xii			N/A		4.0

Equation 1: Calculation of Allowance for Enhanced-performance Integrated Displays

$$EP = \begin{cases} 0, \text{ No Enhanced Power Displays} \\ 0.3 \text{ Enhanced Performance Display d} < 27 \\ 0.75 \text{ Enhanced Performance Display d} \geq 27 \end{cases}$$

Where

vi TEC_{MEMORY} Adder: Applies per GB installed in the system.

vii $TEC_{GRAPHICS}$ Adder: Applies to only the first dGfx installed in the system, but not Switchable Graphics.

viii FB_BW: Is the display frame buffer bandwidth in gigabytes per second (GB/s). This is a manufacturer declared parameter and should be calculated as follows: (Data Rate [Mhz] × Frame Buffer Data Width [bits]) / (8 × 1000)

ix $TEC_{SWITCHABLE}$ Incentive: Applies to automated switching that is enabled by default in Desktops and Integrated Desktops.

x TEC_{EEE}: Applies per IEEE 802.3az-compliant (Energy Efficient Ethernet) Gigabit Ethernet port.

xi $TEC_{STORAGE}$ Adder: Applies once if system has more than one Additional Internal Storage element.

xii $TEC_{INT\_DISPLAY}$ Adder: EP is the Enhanced Performance Display allowance calculated per **Error! Reference source not found.**; r is the Screen resolution in megapixels; and A is viewable screen area in square inches.

Calculation of E_{TEC_MAX} for Thin Clients

- $E_{TEC\_MAX} = TEC_{BASE} + TEC_{GRAPHICS} + TEC_{WOL} + TEC_{INT\_DISPLAY} + TEC_{EEE}$
- Where:
- TEC_{BASE} is the Base Allowance specified in Table 29;
- $TEC_{GRAPHICS}$ is the Discrete Graphics allowance specified in **Error! Reference source not found.** if applicable;
- TEC_{WOL} is the Wake-on-LAN allowance specified in Table 29 if applicable;
- $TEC_{INT\_DISPLAY}$ is the Integrated Display allowance for Integrated Desktops specified in **Error! Reference source not found.** if applicable; and
- TEC_{EEE} is the Energy Efficiency Ethernet incentive for Desktops specified in **Error! Reference source not found.** if applicable, per IEEE 802.3az-compliant (Energy Efficient Ethernet) Gigabit Ethernet port.

Table 29: Adder Allowances for Thin Clients

Adder	Allowance (kWh)
TEC_{BASE}	31
$TEC_{GRAPHICS}$	36
TEC_{WOL}	2

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