

JRC SCIENCE FOR POLICY REPORT

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

*TECHNICAL REPORT v1.0:
Draft criteria proposals*

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Abstract

EU Green Public Procurement (GPP) Criteria revision for Computers and Monitors Technical report v1.0: 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 ACRONIMS

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

The study has been carried out by the Joint Research (JRC) with technical support from the consulting firm Oeko Institute. 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 first draft of the developed criteria, taking into account the background technical analysis presented in the preliminary report produced by Oeko Institute 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 report will form the basis for the 1st AHWG meeting which will take place on 11th of December 2019 in Seville (Spain).

1.2 Scope definition

The current EU GPP criteria for computers and monitors 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 to date

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:

- 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.

1.2.2 Revised scope proposal

Taking into account the previous comments the following scope is proposed:

Proposed revised scope of the GPP criteria (first proposal)
<p>Stationary ICT devices</p> <ul style="list-style-type: none"> • Computers <ul style="list-style-type: none"> ○ Desktop computers ○ All in one computers (or integrated desktop computers) ○ Desktop Thin clients ○ Workstations • Computer displays <p>Mobile ICT devices</p> <ul style="list-style-type: none"> • Portable computers <ul style="list-style-type: none"> ○ Notebooks ○ Two-in-one notebooks ○ Mobile thin clients • 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 computers (or integrated desktop computers** 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 clients** '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 other ecolabels (e.g. EU Ecolabel, TCO Certified Version 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 cm² 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.
- **A 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.

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.

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).

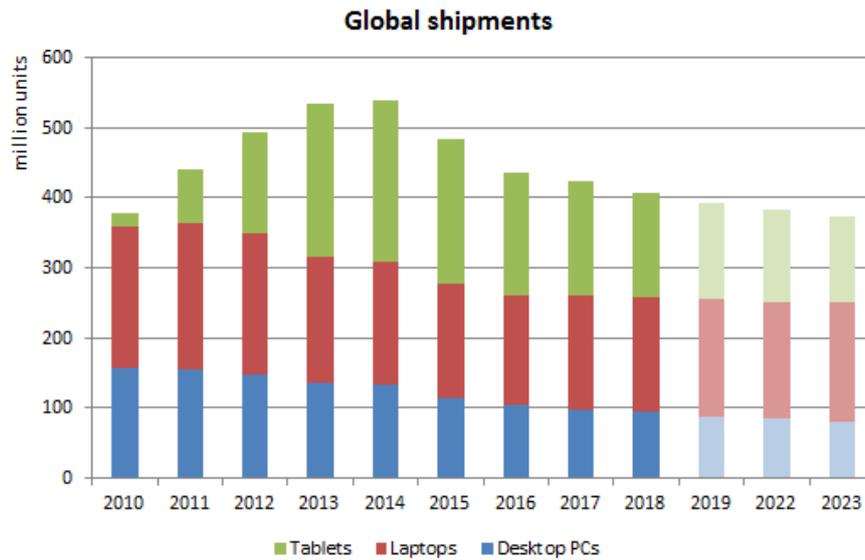


Figure 1 Global shipments 2010-2018. 2019, 2022, 2023 are estimates¹

Desktop PCs in particular 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. 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 2020-2030².

¹<https://www.statista.com/statistics/272595/global-shipments-forecast-for-tablets-laptops-and-desktop-pcs/> (accessed on June 2019)

²Preparatory study on the review of Regulation 617/2017 Computers and Computer Servers – Task 7 (2017) Viegand Maagoe and Vito. <https://computerregulationreview.eu/documents>

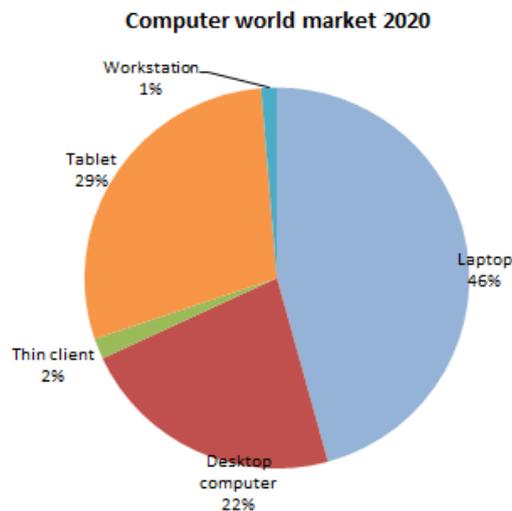


Figure 2 Computer world market 2020³

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 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.

³ Preparatory study on the review of Regulation 617/2017 Computers and Computer Servers – Task 7 (2017) Viegand Maagoe and Vito. <https://computerregulationreview.eu/documents>

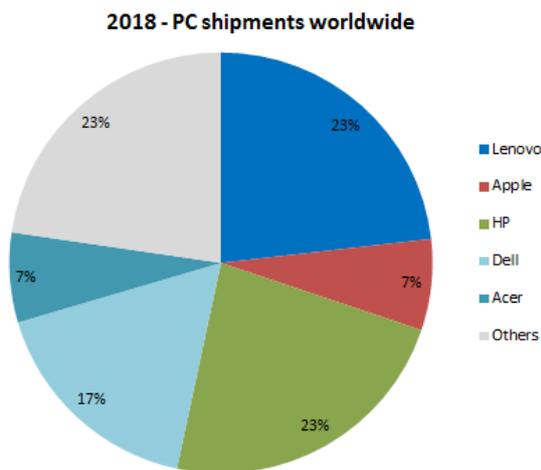


Figure 3 PC shipments by vendor 2018
(Statista, 2019b)

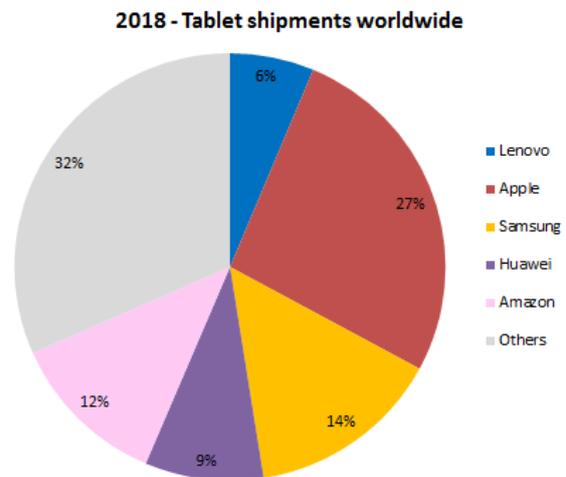


Figure 4 Tablet shipments by vendor 2018
(Statista, 2019c)

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 is expected 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 market⁴. Potential reasons for this decline are:

- 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)

⁴ 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).

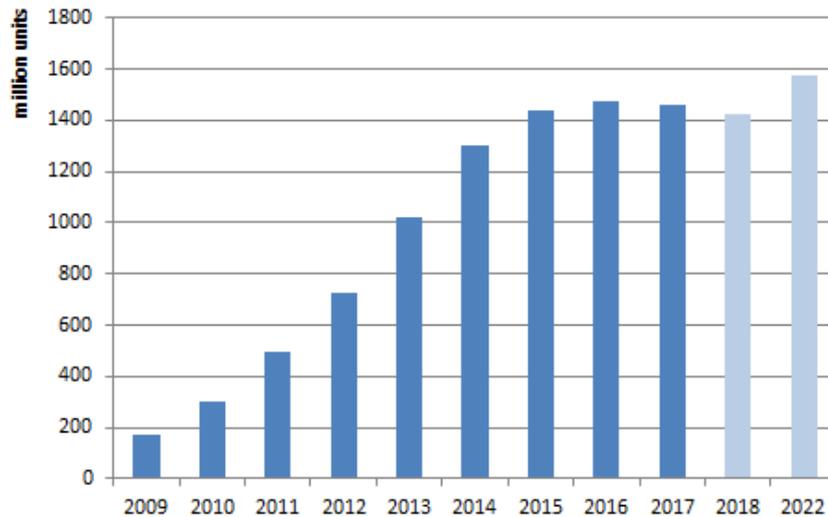


Figure 5 Smartphone shipments worldwide 2010-2017. 2018 and 2022 are estimates⁵

From 2019 onwards, it is expected that 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). It's worth mentioning that Huawei was the only manufacturer which showed growth in 2019⁶. 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).

⁵ 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).

⁶ 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)

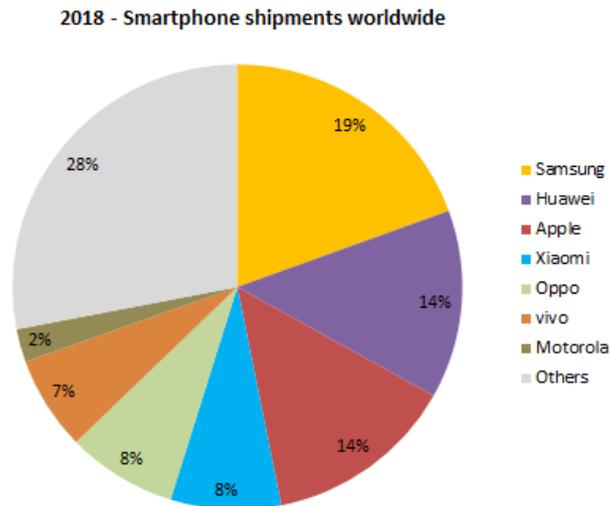


Figure 6 Smartphone shipments worldwide by vendor – 2018 Q1⁷

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).

1.4 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.

The analysis is structured in the following sub-sections: desktop computers and notebooks, tablets, smartphones and new business models. As a general conclusion of this section, similar environmental patterns have been identified for the different devices, and therefore similar strategies may be implemented to reduce the environmental impact of desktop and mobile ICT equipment.

⁷ 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)

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 Potential⁸, although the relative importance between these two differs between product types (e.g. desktop computers and notebooks). Looking at Figure 7 it appears that the dominant contributor to Green House Potential impact is the manufacturing stage.

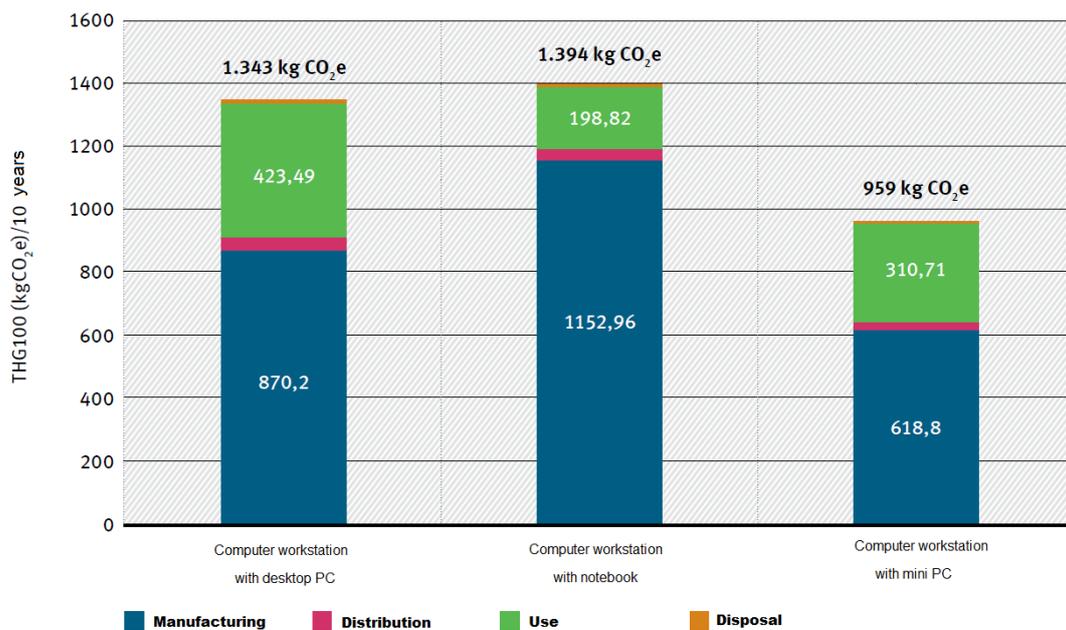


Figure 7 Comparison of the total greenhouse gas potential (THG100) of the three computer workplaces (values rounded, without recycling credits)⁹

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

⁸ Arushanyan et al. (2014) Lessons learned. Review of LCAs for ICT products and services. Computers in Industry.

⁹ Prakash et al. (2016) Computer am Arbeitsplatz: Wirtschaftlichkeit und Umweltschutz - Ratgeber für Verwaltungen. Umweltbundesamt

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 consider the impact of the use phase of the monitor, that adds to a combined 33% of lifecycle emissions¹⁰.

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 amount 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 8: Multi-display use.). A system such as this could increase the energy consumption even with high efficient devices¹¹.

¹⁰ Andrae (2013) Comparative LCA of physical and virtual desktops. Journal of Green Engineering.

¹¹ 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 8: 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 study¹² highlights the potential benefit of using laptops in a secondary application, resulting in a 40% reduction in GHG emissions. Another study¹³ 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.

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 stage¹⁴. 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.

¹² André et al. (2019) Resource and environmental impacts of using second-hand laptop computers: A case study of commercial reuse. *Waste Management*

¹³ The shift project (2019) *Lean ICT – Towards digital sobriety*

¹⁴ Apple, (2019) iPad Air Product Environmental Report.

https://www.apple.com/environment/pdf/products/ipad/iPadAir_PER_Mar2019.pdf ([Accessed on October 2019](#))

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, although distribution of impact among life cycle stages is similar, main ones being manufacturing and use stage¹⁵.

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 size¹⁵. 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 satisfactorily 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 devices¹⁶.

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).

¹⁵ 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 October 2019)

¹⁶ Teehan et al. (2013) Comparing embodied Greenhouse Gas Emissions of modern computing and electronics products. Environmental Science & Technology.

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 accounts for 58% of the total life cycle impact¹⁷. 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 GWP¹⁷. 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 applications¹³.

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 study¹⁸ 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.

¹⁷ Ercan et al. (2016) Life cycle Assessment of a Smartphone. ICT for Sustainability.

¹⁸ Suckling et al. (2015) Redefining scope: the true environmental impact of smartphones? International Journal of Life Cycle Assessment.

Redundancy of devices is another aspect contributing to the impact of the ICT equipment, like smartphones. Initiatives which consist 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 emissions¹³.

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 phone¹⁹. Similar findings, but at a larger scale, were obtained for notebooks, where 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 manufacture⁹. 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%¹³.

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

¹⁹ Frey et al. (2006) Ecological footprint analysis applied to mobile phones. Massachusetts Institute of Technology and Yale University.

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 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 markets¹⁸. 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 study²⁰ 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:

²⁰ 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 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.)
- 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 9 illustrates some examples which are the assumed routes based on current knowledge on the market.

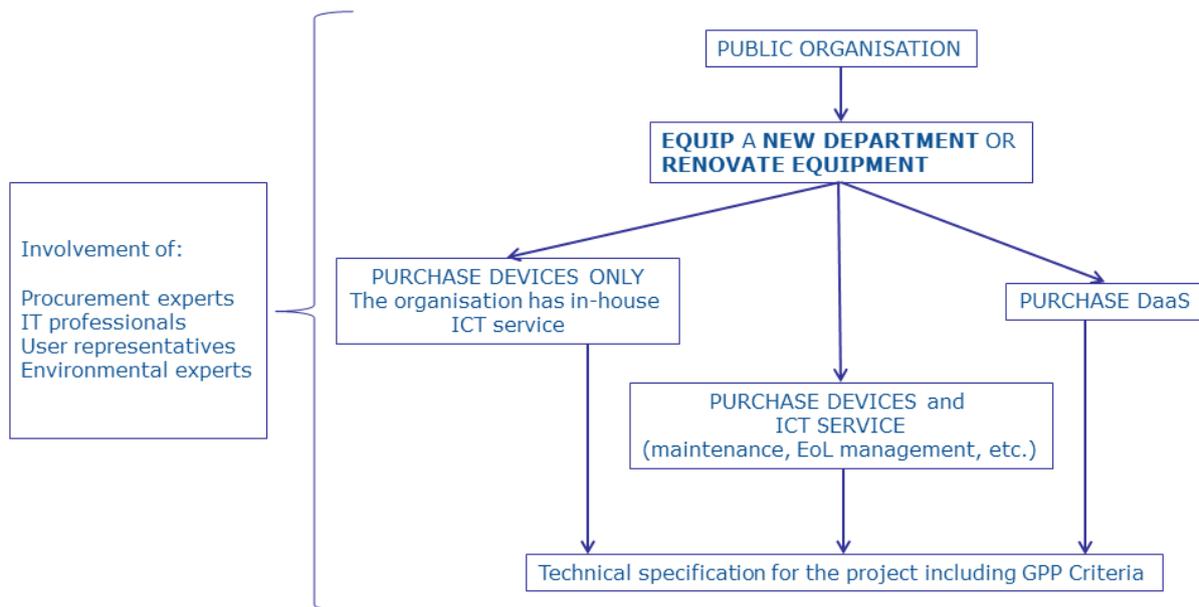


Figure 9: Possible procurement routes identified for public organisations

2. DRAFT CRITERIA AREAS AND PROPOSALS

2.1 Criteria area 1 – 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 2018²¹
- the adoption in 2019 of new regulations on ecodesign²² and energy labelling²³ 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 2.1.2.1).

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

²¹ <https://ec.europa.eu/energy/en/energy-star>

²² https://ec.europa.eu/energy/sites/ener/files/documents/c-2019-2122_1_en_act_part1_v7.pdf

²³ https://ec.europa.eu/info/law/better-regulation/initiative/1948/publication/4145543/attachment/090166e5c2464931_en

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 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 1 Energy consumption current criteria (2016) and TR v1.0I

GPP 2016	TR v1.0 Proposal
TS1 Minimum Energy Performance of Computers (based on Energy Star) <i>(core and comprehensive)</i>	TS1 Minimum Energy Performance of Computers (based on the IEC Standard 62623:2012)
TS2 Minimum Energy Performance of Monitors (based on Energy Star) <i>(core and comprehensive)</i>	TS2 Minimum Energy Performance of Monitors (based on Energy Label) <i>(core and comprehensive)</i>
	New! TS3 Thin Client devices in a server based network
AC 1 Improvement of energy consumption upon the specified Energy Star Standard <i>(core and comprehensive)</i>	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)

First criteria proposal	
Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATIONS	
TS1. Minimum Energy performance for computers The calculated Typical Energy Consumption (E _{TEC}) for each equipment delivered as part of the contract must	TS1. Minimum Energy performance for computers The calculated Typical Energy Consumption (E _{TEC}) for each equipment delivered as part of the contract must

<p>be less than or equal to the Maximum ETEC requirement as for the Annex I</p> <p>Verification:</p> <p>Tenderers must report the Typical Energy Consumption (E_{TEC}) value, based on testing and calculations according to the IEC Standard 62623:2012.</p> <p>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:</p> <ul style="list-style-type: none"> • Energy Star Version 6.1 • TCO Certified Version 8 <p>As alternative test results obtained by accredited ISO17025 test bodies according to the IEC 62623:2012 standard are accepted as proof of compliance.</p>	<p>be less than or equal to the Maximum ETEC requirement as for the Annex II</p> <p>Verification:</p> <p>Tenderers must report the Typical Energy Consumption (E_{TEC}) value, based on testing and calculations according to the IEC Standard 62623:2012.</p> <p>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:</p> <ul style="list-style-type: none"> • Energy Star Version 7.0 or 7.1 • TCO Certified Version 8 (only in case the certificate show compliance with Energy Star 7.0 version) • 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) • TÜV Green Product Mark 2PFG-E 2354:07.2018 for Portable Computers <p>As alternative test results obtained by accredited ISO17025 test bodies according to the IEC 62623:2012 standard are accepted as proof of compliance</p>
<p>TS2. Minimum energy performance of monitors</p> <p>The Energy Efficiency Index for each model delivered as part of the contract must be in the range of Energy Classes A-E as for the energy efficiency classes set out in the Annex I of the Commission Delegated Regulation (EU) No XX of XXXX²⁴</p> <p>Verification</p> <p>The tenderer must provide for each model delivered the valid Energy Label issued according to the EU's Energy Labelling framework Regulation (2017/1369).</p> <p>Products labelled as Class A, B, C, D or E will be deemed to comply</p>	<p>TS2. Minimum energy performance of monitors</p> <p>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 XX of XXXX</p> <p>Verification</p> <p>The tenderer must provide for each model delivered the valid Energy Label issued according to the EU's Energy Labelling framework Regulation (2017/1369).</p> <p>Products labelled as Class A, B, C, D will be deemed to comply</p>
	<p>New! TS3: Thin Client devices in a server based environment,</p> <p><i>The inclusion of this Technical Specification can be generally taken into consideration where a certain number (e.g. >15 personal workplaces) equipment is</i></p>

²⁴ To be updated when published in the Official Journal. The regulation was adopted on October 1st 2019.

used in a cloud 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 explanatory note below)

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 Explanatory Note below .

Products holding a relevant Type I Eco-label fulfilling this specified requirement will be deemed to comply.

Explanatory Note: Calculation of ETEC_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
- TEC_{GRAPHICS} is the Discrete Graphics allowance (if applicable)
- TEC_{WOL} is the Wake-on-LAN allowance specified (if applicable)
- TEC_{INT_DISPLAY} is the Integrated Display allowance for Integrated Desktops (if applicable)
- TEC_{EEE} is the Energy Efficiency Ethernet incentive for Desktops per IEEE 802.3az-compliant (Energy Efficient Ethernet) Gigabit Ethernet port.

Table: Allowances for Thin Clients

Adder	Allowance (kWh)
TEC _{BASE}	31
TEC _{GRAPHICS}	36
TEC _{WOL}	2
TEC _{INT_DISPLAY}	$8.76 \times 0.35 \times (1+EP) \times (4xr + 0.05xA)$ $EP = \{$ <p>0, No Enhanced Performance Display</p> <p>0.3, Enhanced Performance Display, $d < 27$</p> <p>0.75, Enhanced Performance Display, $d \geq 27$</p> <p>Where:</p> <ul style="list-style-type: none"> - d is the diagonal of the screen, in inches; - r is the resolution - A is the area of the screen

TEC _{EEE}	8.76 × 0.2 × (0.15 + 0.35)																											
AWARD CRITERIA																												
<p>AC1. Improvement in the energy consumption upon the specified Energy Consumption threshold for computers</p> <p><i>It is recommended to use this criterion in conjunction with TS1 for desktop computers if the products specified are for graphics intensive uses.</i></p> <p>Points will be awarded if the product is more energy efficient than the E_{TEC_MAX} value required under TS1.</p> <p>A maximum of x points [<i>to be specified</i>] may be awarded. Points must be awarded in proportion to the improvement in energy efficiency as follows:</p> <ul style="list-style-type: none"> • 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 <p>Verification:</p> <p>Tenderers must report the Typical Energy Consumption (E_{TEC}) value, based on testing and calculations according to the IEC Standard 62623:2012.</p>	<p>AC1. Improvement in the energy consumption upon the specified Energy Consumption threshold for computers</p> <p><i>It is recommended to use this criterion in conjunction with TS1 for desktop computers if the products specified are for graphics intensive uses.</i></p> <p>Points will be awarded if the product is more energy efficient than the E_{TEC_MAX} value required under TS1.</p> <p>A maximum of x points [<i>to be specified</i>] may be awarded. Points must be awarded in proportion to the improvement in energy efficiency as follows:</p> <ul style="list-style-type: none"> • 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 <p>Verification:</p> <p>Tenderers must report the Typical Energy Consumption (E_{TEC}) value, based on testing and calculations according to the IEC Standard 62623:2012.</p>																											
<p>AC2. Improvement in the energy consumption upon the specified Energy Consumption threshold for monitors</p> <p>Points will be awarded if the product is in an energy class higher than E.</p> <p>A maximum of x points [<i>to be specified</i>] may be awarded. Points must be awarded in proportion to the improvement in energy efficiency Class as follows:</p> <table border="1" data-bbox="188 1585 785 1980"> <thead> <tr> <th>Energy efficiency class</th> <th>Energy Efficiency Index EEI</th> <th>Points</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>$EEI < 0.30$</td> <td>x point</td> </tr> <tr> <td>B</td> <td>$0.30 \leq EEI < 0.40$</td> <td>0.75x points</td> </tr> <tr> <td>C</td> <td>$0.40 \leq EEI < 0.50$</td> <td>0.50x points</td> </tr> <tr> <td>D</td> <td>$0.50 \leq EEI < 0.60$</td> <td>0.25x points</td> </tr> </tbody> </table>	Energy efficiency class	Energy Efficiency Index EEI	Points	A	$EEI < 0.30$	x point	B	$0.30 \leq EEI < 0.40$	0.75x points	C	$0.40 \leq EEI < 0.50$	0.50x points	D	$0.50 \leq EEI < 0.60$	0.25x points	<p>AC2. Improvement in the energy consumption upon the specified Energy Consumption threshold for monitors</p> <p>Points will be awarded if the product is in an energy class higher than D.</p> <p>A maximum of x points [<i>to be specified</i>] may be awarded. Points must be awarded in proportion to the improvement in energy efficiency Class as follows:</p> <table border="1" data-bbox="809 1574 1401 1901"> <thead> <tr> <th>Energy efficiency class</th> <th>Energy Efficiency Index EEI</th> <th>Points</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>$EEI < 0.30$</td> <td>x point</td> </tr> <tr> <td>B</td> <td>$0.30 \leq EEI < 0.40$</td> <td>0.66x points</td> </tr> <tr> <td>C</td> <td>$0.40 \leq EEI < 0.50$</td> <td>0.33x points</td> </tr> </tbody> </table>	Energy efficiency class	Energy Efficiency Index EEI	Points	A	$EEI < 0.30$	x point	B	$0.30 \leq EEI < 0.40$	0.66x points	C	$0.40 \leq EEI < 0.50$	0.33x points
Energy efficiency class	Energy Efficiency Index EEI	Points																										
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2.1.1 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.

2.1.1.1 *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 still ongoing and, the preparatory study has investigated approaches based on the energy efficiency under the active state.

The current ecodesign and Energy Star approach is mainly based on a Typical Energy Consumption (Etec) based on a combination of use profile under sleep and idle mode.

As shown in Figure 10, according to Mills and Mills (2016)²⁵, 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).

²⁵ 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

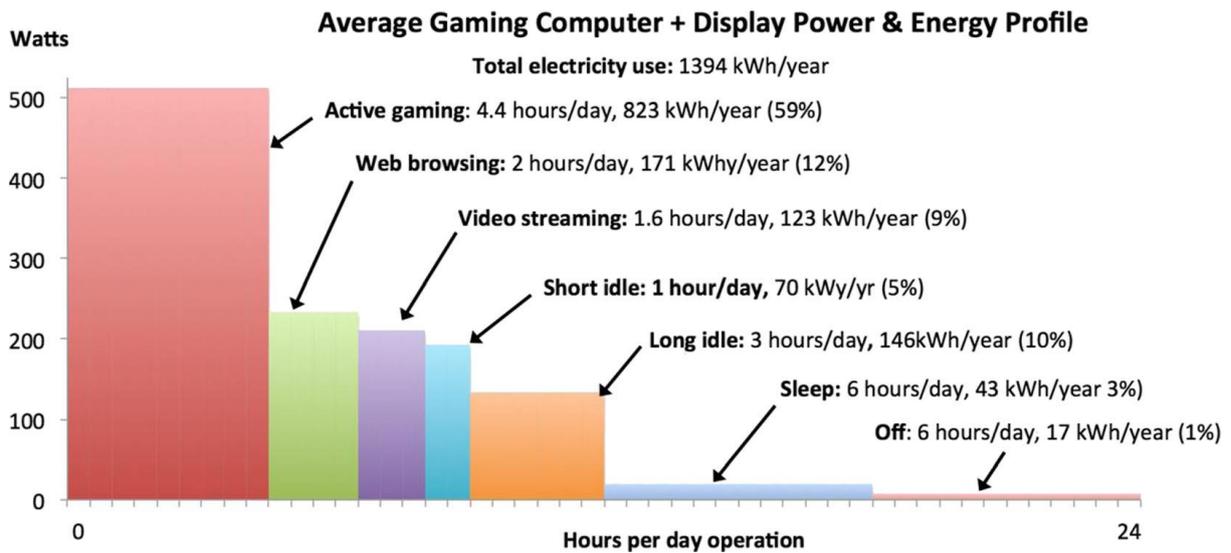


Figure 10 Measured power and energy use for different mode of operation

In the meantime, the standard IEC/EN 62623:2012 can be considered as the main methodological reference for the measurement of 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 (version 6.1 for core criteria and version 7.0 for comprehensive criteria). The current proposal of revision aims to find a balance between energy performance, material efficiency aspects (e.g. durability, reparability, recyclability and recycled content) as well as the use of safer chemicals. For this reason, despite several top performing computers on the market are able to meet Energy Star 7.0 thresholds, 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. For this reason the Energy Star 7.0 thresholds are proposed as comprehensive criteria.

At the time of publication of this standard there are around 1500 computers models that are compliant to the EU Energy Star version 7, with 850 models of notebooks and 260 desktop computers. 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).

2.1.1.2 *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 server²⁶.

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 certain number of personal workplaces (e.g. >15) is 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.

The benefits include:

- **Lower energy consumption:** Thin clients generally use far less energy than desktop computers²⁷. 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 clients computer currently registered under US Energy Star have an average annual E_{TEC} of 30 kWh²⁸.

²⁶ 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

²⁷ 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.

²⁸ <https://www.energystar.gov/productfinder/product/certified-computers/results>

- **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.

2.1.1.3 *Computer monitors*

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

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 Figure 11). Based on this, class E is proposed as threshold for the Core Criteria and class D as threshold for comprehensive criteria. Moreover, the comprehensive 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.

An alternative approach could be to set tiers valid in time, based on assumptions related to the progressive improvement of displays on the market. 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 2 Energy efficiency classes and corresponding Energy Efficiency Index for displays

Energy efficiency class	Energy Efficiency Index (EEI)
A	$EEI < 0.30$
B	$0.30 \leq EEI < 0.40$
C	$0.40 \leq EEI < 0.50$
D	$0.50 \leq EEI < 0.60$
E	$0.60 \leq EEI < 0.75$
F	$0.75 \leq EEI < 0.90$
G	$0.90 \leq EEI$

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.

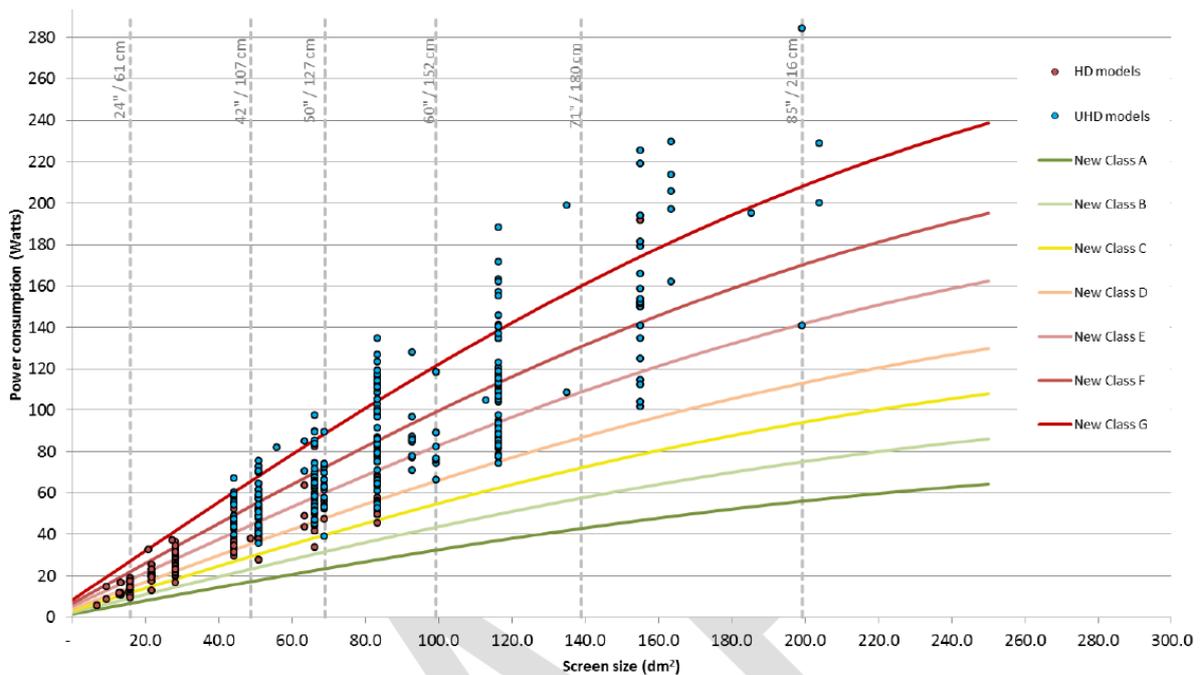
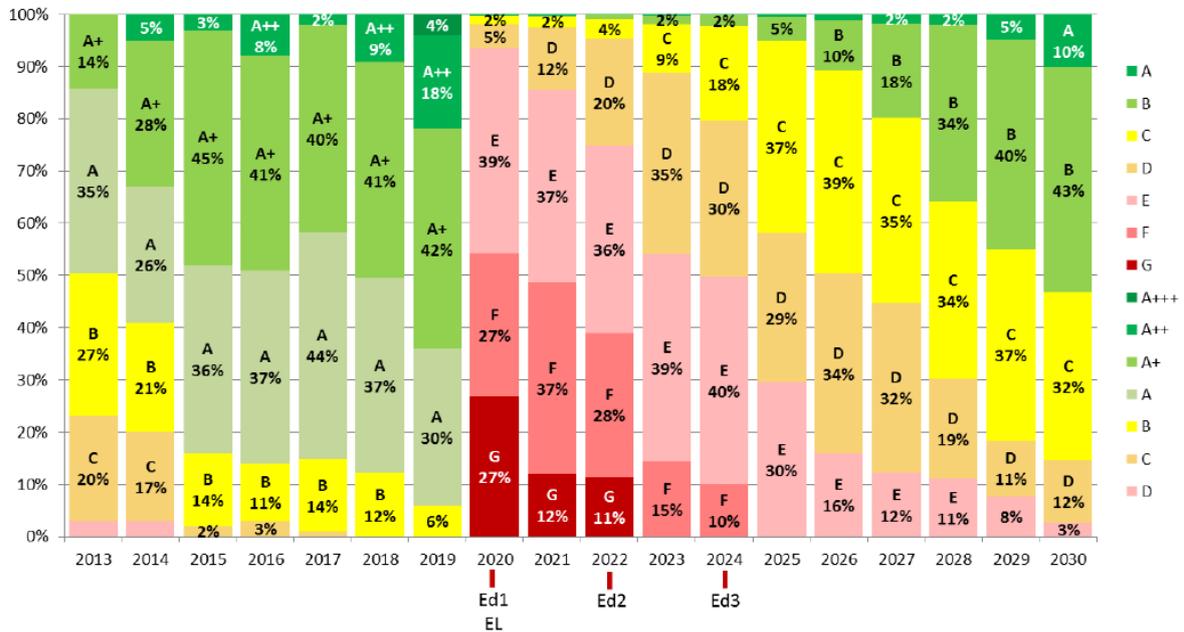


Figure 11: Distribution of displays from the 2018 dataset with projection of expected improvements at entry into force of the rescaled labels



2.1.1.4 Batteries

The estimation of how long a battery can last under certain use profiles is possible for computers. Benchmark softwares like BAPCo MobileMark²⁹ and PC Mark³⁰ 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 standard use profile, which could imply different ranking of 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.

²⁹ E.g. <https://bapco.com/products/mobilemark-2018/> or PC Mark

³⁰ <https://benchmarks.ul.com/news/pcmark-10-introduces-a-better-way-to-test-battery-life>

2.1.2 Background and rationale for the criteria verification

2.1.2.1 *Computers*

GPP Criteria requesting Energy Star compliance (e. g. by requesting the Energy Star logo on the product within public procurement procedures) would place companies not exporting to the USA, Canada or Japan, such as e.g. EU SMEs, at a competitive disadvantage compared with producers which place products on these markets. Only companies placing their products models also on these markets can apply for Energy Star certifications.

However GPP Criteria, when specifying purchasing criteria for office equipment, might still 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 7.0 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.

2.1.2.2 *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" website³¹ for products information.

³¹ 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)

2.1.3 Summary of stakeholder answers from 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 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.

2.1.4 Discussion points in preparation of the AHWG meeting

Discussion points proposal
<ul style="list-style-type: none">• Expiration of EU – US Energy Star agreement• Active vs idle state energy consumption• Use of benchmarks to verify the efficiency of portable devices• Energy consumption in the manufacturing phase

2.2 Criteria area 2 – 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, this first proposal includes an amendment of the criterion on plasticizers in external cables as some of the former substances are now banned under RoHS directive and the new proposal is in the form of award criteria; another 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 reduction of phthalates. 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.

Table 3 Hazardous substances current criteria (2016) and TR v1.0I

GPP 2016	TR v1.0 Proposal
SC1. Restricted substance controls	SC1. Substance controls
TS3. Declaration for REACH Candidate List substances	TS4. Declaration of Substances of Very High Concern (REACH Candidate List substances)
TS4. Plasticisers in external cables	TS5. Restriction of halogenated substances in plastic parts
AC2(a) Hazardous end of life emissions from the main Printed Circuit Board (motherboard)	AC3 Restriction of Substances of Very High Concern
AC2(b) Hazardous end of life emissions from external power cables	New! AC4 Avoidance of phthalates

First proposal	
Core criteria	Comprehensive criteria
SELECTION CRITERIA	
	SC1. Substance controls

	<p>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.</p> <p>Product evaluations according to the SCs should, as a minimum, cover the following areas:</p> <ul style="list-style-type: none"> - Product planning/design; - Supplier conformity; - Analytical testing. <p>The SCs must apply, as a minimum, to REACH Candidate List substances.</p> <p>The IEC 62474 material declaration database ³² must be used as the basis for identifying, tracking and declaring specific information about the composition of the products to be supplied. The SCs must be used to ensure that the tenderer is aware of the presence or non-presence of substances that are listed in the IEC 62474 database.</p> <p>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:</p> <ul style="list-style-type: none"> - restricted substance requirements change; - if supplied materials, parts and sub-assemblies change; - if manufacturing and assembly operations change. <p>Implementation of the SCs must be with reference to the guidance in IEC 62476 or equivalent and the IEC 62474 material declaration database.</p> <p>Verification: The tenderer must provide documentation, which describes the system, its procedures and proof of its implementation.</p>
TECHNICAL SPECIFICATIONS	
<p>TS4. Declaration of Substances of Very High Concern (REACH Candidate List substances)</p> <p>The tenderer must declare the presence of any Substance of Very High Concern (SVHC, REACH Candidate List substances) at a concentration of greater than 0.1% (weight by weight) in the whole</p>	<p>TS4. Declaration of Substances of Very High Concern (REACH Candidate List substances)</p> <p>The tenderer must declare the presence of any Substance of Very High Concern (SVHC, REACH Candidate List substances) at a concentration of greater than 0.1% (weight by weight) in the whole</p>

³² International Electrotechnical Commission (IEC), *IEC 62474: Material declaration for products of and for the electrotechnical industry*, <http://std.iec.ch/iec62474>

<p>product</p> <p>Verification:</p> <p>The tenderer must provide a declaration identifying Substances of Very High Concern that are present.</p>	<p>product and in each of the following sub-assemblies:</p> <ul style="list-style-type: none"> - 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) <p>Verification:</p> <p>The tenderer must provide a declaration identifying Substances of Very High Concern that are present.</p>
<p>TS5. Restriction of halogenated substances in plastic parts</p> <p>The use of halogenated substances is not permitted in plastic parts that weigh more than 25 grams (5 g for smartphones).</p> <p>Exemptions are:</p> <p>Printed Circuit Boards and cable insulation.</p> <p>Verification:</p> <p>The tenderer must provide documentation which proves that the requirement has been met by either:</p> <ul style="list-style-type: none"> • 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). <p>In case exemptions are used a declaration by the manufacturer must be provide.</p> <p>Equipment holding a relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.</p>	<p>TS5. Restriction of halogenated substances in plastic parts</p> <p>The use of halogenated substances is not permitted in plastic parts that weigh more than 25 grams (5 g for smartphones).</p> <p>Verification:</p> <p>The tenderer must provide documentation which proves that the requirement has been met by either:</p> <ul style="list-style-type: none"> • 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). <p>Equipment holding a relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.</p>
AWARD CRITERIA	
AC3 Restriction of Substances of Very High	AC3 Restriction of Substances of Very High

<p>Concern</p> <p>Points must be awarded when no REACH Candidate List substances are intentionally added above 0.1% (weight by weight) in the whole product.</p> <p>Compliance to be ensured for the latest version of the SVHC list available at the moment of tendering.</p> <p>Verification:</p> <p>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.</p> <p>Equipment holding a relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.</p>	<p>Concern</p> <p>Points must be awarded when no REACH Candidate List substances are intentionally added above 0.1% (weight by weight) in the whole product and in each of the following sub-assemblies:</p> <ul style="list-style-type: none"> - 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) <p>Compliance to be ensured for the latest version of the SVHC list available at the moment of tendering.</p> <p>Verification:</p> <p>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.</p> <p>Equipment holding a relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.</p>
	<p>New! AC4 Avoidance of phthalates</p> <p>Points must be awarded when safer substances are used to substitute phthalates.</p> <p>Points are awarded based on the average score obtained by a rating system for substances (e.g. GreenScreen Certified™).</p> <p>Verification:</p> <p>The must provide evidence that the substances used are included in a positive list, e.g. GreenScreen Certified™.</p>

2.2.1 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.

REACH Candidate List Substances

Regarding the REACH Candidate List Substances, the criterion TS5 on the declaration of the presence of these substances has been kept, as it is still considered to be a useful step in raising awareness in public authorities of the availability of this information and how it can be used to identify the presence/non-presence of SVHC. 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. 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 analysis³³ 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.

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 4; for example EPEAT allows exceeding the

³³ More details on the analysis of voluntary approached and the list of documents revised can be found in the preliminary report.

limits proposed in their requirement when the compound used has a GreenScreen Safer Chemical 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. The revised Ecodesign regulation on displays includes a ban of halogenated flame retardants in the enclosure and stand of electronic displays. With such controls from industry on the restriction to halogenated flame retardants and the coverage in the existing eco-labelling schemes as well as in the revised Ecodesign Directive for displays, a criterion to restrict halogenated substances has been introduced. The comprehensive criterion covers all plastic parts of more than 25 grams (5 g for smartphones) present in the device while the core criterion exempts PCBs and cable insulation.

Table 4 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	PCB laminates, electronic

	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.	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
TUV	Covers product materials	Cables

The list of restricted substances in Annex II of the **RoHS Directive** has been amended by the Commission Delegated Directive (EU) 2015/863 of 31 March 2015. 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 to award those offers that **reduce the usage of phthalates** by substituting these plasticizers with safer alternatives. The RoHS Directive 2011/65/EU³⁴ also prohibits the use of lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) in electrical and electronic equipment placed on the Union market.

³⁴

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

2.2.2 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 ISO type I label fulfilling the respective requirements.

Regarding the reduction of the usage of phthalates, it is proposed to use the approach of a positive list, rather than banning substances. An example that could be implemented is provided by GreenScreen Certified™.

2.2.3 Summary of stakeholder answers from the 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 declaration³⁵.

2.2.4 Discussion points for the preparation of the AHWG meeting

Discussion points proposal
<ul style="list-style-type: none">• Alternative approach to award a positive list of substances

- Alternative approach to award a positive list of substances

³⁵ <https://www.ecma-international.org/publications/standards/Ecma-370.htm>

2.3 Criteria area 3 – Product lifetime extension

2.3.1 Criterion 3.1 – Reparability, Reusability and Upgradeability

Compared to the current set of criteria 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.

New technical specifications have been proposed in order to increase the reusability of products:

- on the provision of remanufactured / refurbished products
- on the provision of software for secure data erasure.

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

- **Table 5 Reparability, reusability and upgradeability current criteria (2016) and TR v1.0I**

GPP 2016	TR v1.0 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

	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

First criteria proposal	
Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATIONS	
<p>TS6 (a). Provision of an extended services agreement</p> <p>The tenderer must provide a minimum of two years services as detailed in the Service Level Requirements document (See explanatory note below)</p> <p>Verification:</p> <p>The tenderer must provide a written declaration that the products supplied will be warranted in conformity with the contract specifications and the related service level agreement.</p>	<p>TS6 (a). Provision of an extended services agreement</p> <p>The tenderer must provide a minimum [three] – [four] years services as detailed in the Service Level Requirements document (See explanatory note below)</p> <p>Verification:</p> <p>The tenderer must provide a written declaration that the products supplied will be warranted in conformity with the contract specifications and the related service level agreement.</p>
<p>EXPLANATORY NOTE: 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:</p> <ul style="list-style-type: none"> • 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 (whoever 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 	

<ul style="list-style-type: none"> • 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. • 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 compatible with costs and time, the service provider commits to implement a repair / upgrade of the equipment instead of an equipment substitution. 	
<p>TS6(b) Manufacturer's warranty The tenderer must provide products covered by at least two years of manufacturer's warranty</p> <p>Verification: The tenderer must provide written evidence of the manufacturer's warranty.</p>	<p>TS6(b) Manufacturer's warranty The tenderer must provide products covered by at least three years of manufacturer's warranty</p> <p>Verification: The tenderer must provide written evidence of the manufacturer's warranty</p>
<p>TS7(a) Continued availability of spare parts</p> <p><i>This criterion is not relevant in case repair / replacement of components is already covered by a service agreement.</i></p> <p>The tenderer must guarantee the availability of spare parts (critical components), including as a minimum those identified in criterion TS5(b), for at least X years from the date of purchase.</p> <p>All critical components identified must be:</p> <ul style="list-style-type: none"> • available to be purchased • or replaced by a service network for repair and maintenance <p>Verification: The tenderer must provide a declaration that critical components will be available. Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.</p>	<p>TS7(a) Continued availability of spare parts</p> <p><i>This criterion is not relevant in case repair / replacement of components is already covered by a service agreement.</i></p> <p>The tenderer must guarantee the availability of spare parts (critical components), including as a minimum those identified in criterion TS5(b), for at least y years from the date of purchase.</p> <p>All critical components identified must be:</p> <ul style="list-style-type: none"> • available to be purchased • or replaced by a service network for repair and maintenance <p>Verification: The tenderer must provide a declaration that critical components will be available. Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.</p>
<p>TS7(b) Design for reparability</p> <p>The following parts (critical components) must be easily accessible and replaceable by common available tools (or no tools):</p> <ul style="list-style-type: none"> - 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 - All-in-One PCs: External/internal PSU, Storage (SSD, HDD, ODD, RAM), System/motherboard - Tablets: Battery, Display Panel / Display assembly, External/internal PSU - Smartphones: Battery, Display Panel/Display assembly, Charger 	

- **Displays:** Connectivity cables, Power cables, External PSU

Instructions on how to replace the parts must be provided with the service manual. The manual must include an exploded diagram of the device illustrating the parts that can be accessed and replaced, and the tools required. The service manual must be available online for anyone to read, free of charge.

Verification:

The tenderer must provide:

- 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.

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

EXPLANATORY NOTE:

List of Commonly available tools for Computers³⁶

- Screw driver 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 tools more specific for Tablets and Smartphones

- Different types of screw drivers: Phillips, Flathead, Torx, Torx Security, Pentalobe)
- Plastic triangle opening tool
- Suction cup

³⁶ Cordella M, Alfieri F, Sanfelix J, Analysis and development of a scoring system for repair and upgrade of products – Final report, EUR 29711 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-01602-1, doi:10.2760/725068, JRC114337

	<p>New! TS8 Refurbished Products</p> <p>An X% of the equipment provided as part of the contract must be a refurbished products.</p> <p>Minimum requirements in terms of quality for refurbished products must be set (see the explanatory note for examples).</p> <p>Verification</p> <p>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).</p>
<p>Explanatory note: examples of requirements for refurbished ICT products</p> <p>Operating status: in perfect working order and cleanliness</p> <p>Aesthetic grade: micro scratches, invisible to more than 20cm</p> <p>Battery state: new and compatible, with the same technical specifications of the original one</p> <p>Accessories: New and compatible charger, USB cable, headphones.</p> <p>Warranty: a minimum one year extended warranty services offered with the product</p>	
	<p>New! TS9. Functionality for secure data deletion</p> <p>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.</p> <p>Verification.</p> <p>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".</p> <p>Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.</p> <p>Labels currently fulfilling this requirement include among others TCO Certified.</p>
<p>Explanatory Note</p> <p>A functionality for secure data deletion could be implemented by means of technical solutions such as, but not limited to:</p> <ul style="list-style-type: none"> • 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. 	
<p>CONTRACT PERFORMANCE CLAUSES</p>	
<p>CPC1 Service Agreement</p> <p><i>To be used in conjunction with the TS on Service Agreement</i></p> <p>The tenderer must provide periodical [<i>monthly / annually</i>] reporting on its compliance with all the metrics, Key</p>	

Performance Indicators and other indicators defined by the Service Level Agreement

EXPLANATORY NOTE: Examples of 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: $\geq 90\%$.
- **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.

2.3.1.1 *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 JRC³⁷.
- A second technical specification requiring the provision of products with manufacturer's warranty.

³⁷See

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

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.

Manufacturer warranty

Many times the tenderers are IT service providers and not manufacturers of IT equipment. Thus, the manufacturer warranty has been included in the revised GPP requirements but separated from the service criteria.

Among the analysed ecolabels, only TCO 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 laptop³⁸:
 - 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 smartphones³⁹ and are mainly applied for the repair of tablets and smartphones. It includes:

³⁸ The applicability of this list is considered extendable also to desktop computers and computer displays.

- 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.
- IEEE: 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

³⁹ <https://susproc.jrc.ec.europa.eu/E4C/documents.html>

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. IEEE optional criteria require replacement either without tools or with commonly available tools, and without the use of external heat sources. Further, 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 center.

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 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 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.

Refurbished equipment

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' which are based on full testing to meet the same functional standards as new products and have a one-year guarantee (cf. section 4.2.4). This is also the case of Fairphone offers 'Refurbished Products' (Fairphone 2: New Life Edition). 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' smartphones: Samsung engineers take the old devices apart, inspect them, replace damaged parts, reassemble them and update the software. Each remanufactured 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.

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 HDD 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 be built-in (or as a 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).

2.3.1.2 Background and rationale for the proposed verification

Provision of an extended warranty

At the tendering stage a written declaration from the tenderer that the products supplied will be warranted 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 version 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.

Refurbished / remanufactured products

The tenderer must 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 could benefit from labelling schemes on the quality of refurbished products.

2.3.1.3 *Summary of stakeholder answers from the 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.

Extending warranty is considered as something that can be asked to offer 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 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 respondent consider 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).

2.3.1.4 *Discussion points in preparation of the AHWG meeting*

Discussion points proposal
<ul style="list-style-type: none">• Extended warranty by manufacturer vs service agreement• Availability of spare parts for different product groups• Disassemblability of critical parts• Certification schemes for refurbished products

2.3.2 Criterion 3.2 – Rechargeable battery life and endurance

In addition to the endurance requirements for batteries, it is proposed to have a software related technical specification in order to ensure a correct management of the batteries of mobile equipment according to their "state of health" and "state of charge" (SoC), and the number of full charge cycles already performed from the battery. Moreover it is proposed a Technical Specification aiming to the provision of a Battery Protection Software able to limit the battery aging. A Technical Specification on minimum requirements in terms of electrical performance of the battery has been also proposed.

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

- **Table 6 Rechargeable battery life and endurance current criteria (2016) and TR v1.01**

GPP 2016	TR v1.0 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

Frist criteria proposal	
Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
<p>TS10.Rechargeable battery endurance <i>Applicable to mobile equipment (laptops / tablets and smartphones)</i> The battery endurance must be greater than 300 battery cycles (with SoC ≥80%). 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 I_t A (accelerated test procedure) Verification: 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:</p> <ul style="list-style-type: none"> • Blue Angel • TCO Certified equipment (with the certificate the 80% capacity retention) • EPEAT certified equipment (with evidence of 	<p>TS10. Rechargeable battery endurance <i>Applicable to mobile equipment (laptops / tablets and smartphones)</i> The battery endurance must be: greater than 500 cycles (with SoC ≥80%), 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 I_t A (accelerated test procedure). Verification: 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:</p> <ul style="list-style-type: none"> • Blue Angel

fulfilling the optional criteria 4.4.1.2)	
	<p>New! TS11. Minimum requirements on the electrical performance</p> <p>The battery must be compliant with the electrical test acceptance criteria according to standard IEC EN 61960-3:2017</p> <p>Verification</p> <p>Tenderers must provide test results obtained by accredited ISO17025 test bodies.</p>
<p>New! TS12. Information on battery state of health</p> <p>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.</p> <p>The software must also provide tips for users to maximize battery lifespan</p> <p>Verification:</p> <p>The tenderer must provide the specifications and version the software.</p>	
<p>New! TS13. Battery protection software</p> <p>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. Such functionality must prevent the battery to be loaded at full charge. The user manual has to be provided with the software</p> <p>Verification:</p> <p>The tenderer must provide the specifications and version the software.</p> <p>Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.</p>	<p>New! TS13. Battery protection software</p> <p>The tenderer must provide the equipment with a pre-installed software 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.</p> <p>Verification:</p> <p>The tenderer must provide the specifications and version the software.</p> <p>Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.</p>
AWARD CRITERIA	
	<p>AC5. Further rechargeable battery endurance</p> <p>Additional points will be awarded if the battery endurance is greater than 500 cycles (with ≥80% capacity retention of the initial rated capacity) proportionally to the additional number of cycles ensured.</p> <p>Verification:</p> <p>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 I_t A (accelerated test procedure) Tenderers must provide test results obtained by accredited ISO17025 test bodies.</p>

EXPLANATORY NOTE: Definition of battery cycle and State of Charge (SoC)

Battery cycle: One battery cycle is completed when the battery is fully discharged from 100% down to 0% and then charged back up to 100%. 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 the same as one full charge-discharge cycle.

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

2.3.2.1 *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.

About the applicable thresholds, 300 cycles at 80% SoC 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 SoC higher than 80% after 300 cycles⁴⁰. 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.

For the comprehensive criteria the following option for the threshold is proposed:

- 500 cycles (with $\geq 80\%$ 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 ($\geq 65\%$ SoC) after 1000 cycles. Some manufacturers (e.g.

⁴⁰Based on anonymized statistics provided by TCO (mid-2019).

Apple) claim for its notebooks and tablets battery capacity at 1000 complete charge/discharge cycles.

On the other hand 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 $0.2 I_t$ A⁴¹ for the number of cycles until a capacity retention > 60% is reached or, as accelerated test option, testing at $0.5 I_t$ A⁴² the capacity retention at 300 cycles. 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.

Table 7 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) ⁴³
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)	This test determines the capacity of a	85% of the rated capacity

⁴¹ It basically means that the battery is tested with a discharging cycle of 5 hours.

⁴² It correspond to an accelerated test condition where the discharging cycle take place in 2 hours.

⁴³ Amount of electricity declared by the manufacturer that a cell can deliver in a 5 hours period

retention after long term storage	battery after extended storage(90 days) at 50% state of charge, followed by a subsequent charge	(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:

- 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.

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.

2.3.2.2 *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.

2.3.2.3 *Summary of stakeholder answers from the 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.

2.3.2.4 *Discussion points in preparation of the AHWG meeting*

Discussion points proposal
<ul style="list-style-type: none">• Definition of thresholds for battery endurance

2.3.3 Criterion 3.4 – Mobile equipment durability testing

The scope of the criteria is expanded to all the categories of mobile equipment, including laptops, tablets and smartphones. A core award criterion aims to ensure that the product is

able to withstand drops and temperature stress. A comprehensive criterion covers 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 8 Mobile equipment durability testing current criteria (2016) and TR v1.0I**

GPP 2016	TR v1.0 Proposal
	New! TS14 Drop testing
	New! TS15: Temperature Stress
	New! TS16 Ingress protection level
AC6. Notebook computer drives	AC6: Mobile equipment durability testing
	New! AC7: Ingress Protection Level – Semi Rugged and Rugged Devices

First criteria proposal	
Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	

<p>New! TS14 Drop testing</p> <p>The equipment must be tested according to the following standards:</p> <ul style="list-style-type: none"> • IEC 60068 Part 2-31: Ec (Freefall, procedure 1), or • MIL-STD-810G w/CHANGE 1 Drop test: Method 516.7 - Shock (procedure IV) <p>with a drop height of 45 cm. Functional performance requirements in Annex III of the criteria document must be met by the equipment after the exposure to the drop test.</p> <p>Verification</p> <p>The tenderer must provide test reports showing that the model has been tested and has met the functional performance requirements for durability.</p> <p>Testing must be carried out by a test facility accredited according to ISO 17025.</p> <p>Existing tests for the product, carried out to the same or a stricter specification, will be accepted without the need to retest.</p> <p>Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.</p>	
	<p>New! TS15: Temperature Stress</p> <p>The equipment must be tested according to the following standards:</p> <ul style="list-style-type: none"> • 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) <p>with the modified storage / operational temperatures described in Annex III.</p> <p>Functional performance requirements in Annex III of the criteria document must be met by the equipment after the exposure to the temperature stress tests.</p> <p>Verification</p> <p>The tenderer must provide test reports showing that the model has been tested and has met the functional performance requirements for temperature stress.</p> <p>Testing must be carried out by a test facility accredited according to ISO 17025.</p> <p>Existing tests for the product, carried out to the same or a stricter specification, will be accepted without the need to retest.</p> <p>Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.</p>

	<p>New! TS16 Ingress protection level</p> <p>The equipment delivered as part of the contract must have passed durability tests carried out according to IEC/EN 60529, The degree of protection provided by enclosures must be classified as level IP54 or higher.</p> <p>Verification</p> <p>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.</p> <p>Existing tests for the product, carried out to the same or a stricter specification, will be accepted without the need to retest.</p> <p>Equipment holding relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.</p>
<p>Explanatory note: Degree of protections as for the IEC/EN 60529:2013</p> <p>Degree of protection against solid foreign objects indicated by the first characteristic numeral</p> <p>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</p> <p>IP6x - No ingress of dust; complete protection against contact;</p> <p>Degree of protection against water indicated by the second characteristic numeral</p> <p>IPx4 – Water splashed against the enclosure from any directions must have no harmful effects.</p> <p>IPx5 - Water is projected in jets against the enclosure from any direction with no harmful effects;</p> <p>IPx6 - Water is projected in powerful jets against the enclosure from any direction with no harmful effects;</p> <p>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</p> <p>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.</p>	
<p>AWARD CRITERIA</p>	

AC6: Mobile equipment durability testing

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/4 points)*
- Resistance to shock (x/4 points)
- Resistance to vibration (x/4 points)
- Screen resilience (x/8 points)
- Temperature stress (x/8 points)*

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

* Only applicable if not already required by TS17 and TS18

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

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 – 0.25 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.

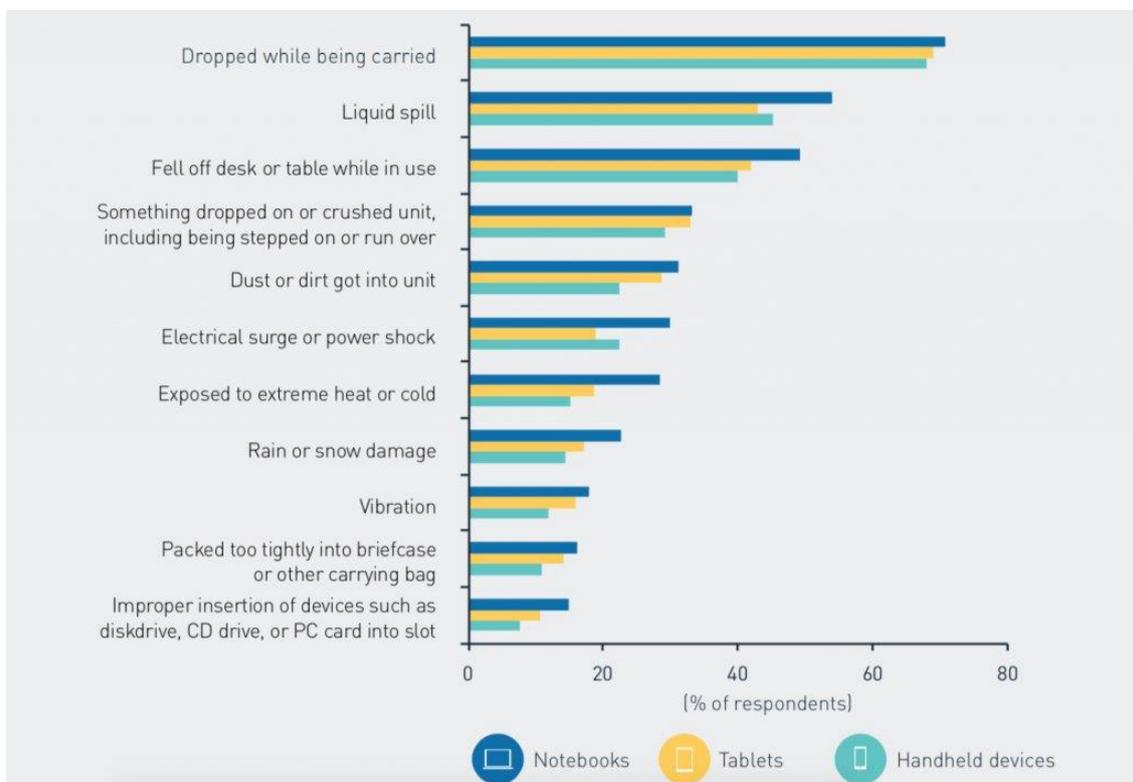
Existing tests for the product, carried out to the same or a stricter specification, will be accepted without the need to retest.

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

2.3.3.1 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)⁴⁴ 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.



⁴⁴ IDC (2016) International Data Corporation - White Paper Pay Now, Save Later: The Business Case for Rugged Devices, http://info.panasonic.com/rs/400-JUK127/images/IDC-report_pay-now-save-later_the-business-case-for-rugged-devices.pdf (accessed on 13 September 2018)

Figure 12: 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 requires a drop test as well as a temperature stress test (high and low temperature); in addition to a drop and temperature stress test, EU GPP criteria 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 **Error! Reference source not found.** Table 9.

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 $\geq 48h$ for storage and $\geq 4h$ for operational temperature.

Table 9 Differences in test conditions of durability tests between EU GPP and TCO

	High temperature	Low temperature	Drop test
EU GPP	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 $\geq 4h$: $\geq +40^\circ\text{C}$ Storage temperature for $\geq 48h$: $\geq +60^\circ\text{C}$;	Operational temperature for $\geq 4h$: $\leq -20^\circ\text{C}$ Storage temperature for $\geq 48h$: $\leq -30^\circ\text{C}$;	≥ 45 cm drop height

According to stakeholder feedback the approach of the durability testing is generally supported. TCO 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.

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, LG⁴⁵, Lenovo⁴⁶), or especially for so called 'rugged' appliances (see examples of Dell⁴⁷ and Zebra Technologies⁴⁸). For the revision of the GPP criteria, it is proposed to introduce TCO 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 of⁴⁹.

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.

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

⁴⁵ <https://www.lg.com/sg/laptops/lg-14Z980-GAA5CA3>

⁴⁶ <https://www.lenovo.com/ww/en/solutions/smb/thinkpad-mil-spec-tested-extreme>

⁴⁷ <https://www.dell.com/en-us/rugged/index.htm>

⁴⁸ <https://www.zebra.com/gb/en/products/tablets/l10-series-xbook-xslate-xpad.html>

⁴⁹ Preparatory study on the Review of Regulation 617/2013 (Lot 3) Computers and Computer Servers

penetration and withstand the pressure of water jets. IP67 or IP68 could help protecting from more severe conditions and risks related to water ingress.

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.

2.3.3.2 *Comments from the 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.

2.3.3.3 *Discussion points in preparation of the AHWG meeting*

Discussion points proposal
<ul style="list-style-type: none"> • Definition of thresholds for different product groups (if necessary)

2.3.4 Criterion 3.5 (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 interface (USB Type-C) 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 that can be achieved by reusing and/or separated procurement for the equipment (cables and external power supplies).

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

- **Table 10 Interoperability and reusability of components current criteria (2016) and TR v1.0I**

GPP 2016	TR v1.0 Proposal
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	New! TS17 Standardized connectors
	New! TS18. Standardized External Power Supply
	New! TS19. External Power Supply: Detachable Cables
	New! TS20 Backward compatibility: adapters
	New! TS21. ICT Equipment without accessories

First criteria proposal	
Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
<p>New! TS17 Standardized connectors</p> <p>The equipment delivered as part of the contract must carry at least one standardized USB Type-C™ receptacle for data exchange that is backward compatible with USB 2.0 according to the standard IEC 62680-1-3:2018.</p> <p>Verification</p> <p>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.</p> <p>Equipment holding a Type I Eco-label fulfilling the specified requirement will be deemed to comply.</p> <p><i>The label that currently ensuring the use of at list one USB Type-C connector is TCO Certified 8.</i></p>	
<p>EXPLANATORY NOTE: Standardized USB Type-C™</p> <p>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.</p>	
	<p>New! TS18. Standardized External Power Supply</p> <p><i>Applicable to portable computing devices with power supplies up to 100 W.</i></p> <p>The equipment delivered as part of the contract must carry a USB Type C standardized receptacle for power supply according to the standard EN/IEC 63002:2017.</p> <p>Verification</p> <p>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.</p>
<p>EXPLANATORY NOTE: Standardized External Power Supply</p> <p>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.</p>	
	<p>New! TS19. External Power Supply: Detachable Cables</p> <p>The External Power Supply (EPS) configuration must consists of an EPS with a detachable input cable (or</p>

	<p>integrated in the EPS housing) and a detachable output cable to the ICT device</p> <p>Verification</p> <p>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.</p>
	<p>New! TS20 Backward compatibility: adapters</p> <p>The following adapters [to be selected from the list below] must be available to be separately procured:</p> <ul style="list-style-type: none"> ○ <i>USB-C to USB Type-A receptacle</i> ○ <i>USB-C to VGA</i> ○ <i>USB-C to HDMI</i> ○ <i>USB-C to RJ45 (Ethernet Port)</i> <p>Verification</p> <p>The tenderer must provide a product specifications and a price list for the adapters required.</p>
	<p>New! TS21. ICT Equipment without accessories</p> <p><i>Applicable in the context of a Framework Agreement</i></p> <p>The equipment model must be available in a version without the following accessories:</p> <ul style="list-style-type: none"> • External Power Supply. (EPS) • Cable • Headphone <p>These accessories must be available to be procured separately.</p> <p>Verification</p> <p>The tenderer must provide a quotation of the model with and without these accessories and a separate quotation for each one of the accessories.</p>

2.3.4.1 *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.

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.

According to the ITU recommendations⁵⁰ 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

⁵⁰ Recommendation ITU-T L.1002. External universal power adapter solutions for portable information and communication technology devices

consists of an EPS with a detachable input cable⁵¹ and a detachable output cable to the ICT device⁵² (see Figure 13). 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.

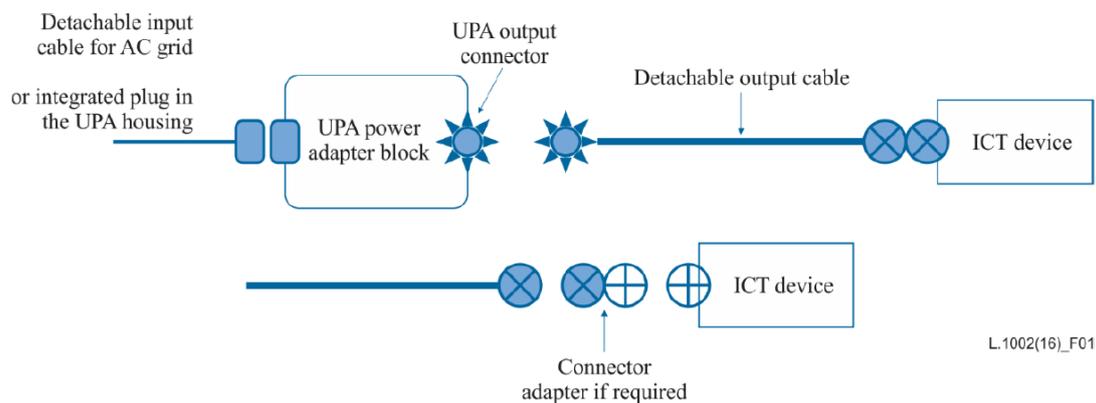


Figure 13: Basic Universal Power Adaptor (UPA) configurations and connection options (Source: ITU-T 2016)

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

⁵¹ 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.

⁵² 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

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 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.

2.3.4.2 *Background for the proposed verification*

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

2.3.5 Criterion 3.6 (new!) – Recycled Content

First criteria proposal	
Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	

	<p>New! TS22: Content of recycled plastic</p> <p><i>This criterion should be used in conjunction with the contract performance clause CPC2 in order to ensure that the claimed content of recycled is respected during the contract performance.</i></p> <p>The tenderer must provide equipment with a minimum 10 percentage (%) of post-consumer recycled plastic by weight of total weight of plastic parts included in the ICT equipment supplied.</p> <p>Verification: The tenderer must provide</p> <ul style="list-style-type: none"> a) Supplier letter(s) stating percentage of applicable content(s) in plastic(s) supplied to manufacturer or to manufacturer's part supplier. b) Documentation of calculation (mass balance), including plastic part name(s) or other part identifiers and the total weight of their plastic content c) If excluding parts, list of excluded parts and reason for exclusion. <p>Certification schemes with conformance assessment based on mass balance and chain of custody requirements can also be accepted as proof of compliance.</p>
CONTRACT PERFORMANCE CLAUSE	
	<p>CPC2: Content of recycled plastic</p> <p>The contractor must provide monthly and annual data for the recycled content of the ICT equipment supplied.</p>

2.3.5.1 *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)⁵³ even require a minimum Post-consumer recycled content (PCC).

- Green Product Mark: minimum 10% PCC
- IEEE (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.
- Optional IEEE criteria 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 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.

⁵³ IEEE Std 1680.1™-2018. IEEE Standard for Environmental and Social Responsibility Assessment of Computers and Displays

It is proposed to include a Technical Specification on minimum post-consumer recycled content .

2.3.5.2 Discussion points in preparation of the AHWG meeting

Discussion points proposal
<ul style="list-style-type: none"> • How to address the verification of the recycled content

2.4 Criteria area 4 – End-of-life management

2.4.1 Criteria 4.1 – Design for recycling

For the new criteria it is proposed to maintain the TS on recyclability of plastic casings. The thresholds for plastic parts size for marking of plastic casings, enclosures and bezels have been updated and a couple of new proposals are included:

- Criterion on the "type of plastics" used for casings, enclosures and bezels.
- Battery marking for the correct identification of the chemistry.

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

- **Table 11 Design for recycling current criteria (2016) and TR v1.0I**

GPP 2016	TR v1.0 Proposal
TS7(a) <i>Recyclability of plastics casings, enclosures and bezels</i>	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

FIRST CRITERIA PROPOSAL	
Core criteria	Comprehensive criteria

TECHNICAL SPECIFICATIONS	
	<p>TS23(a) Recyclability of plastics casings, enclosures and bezels</p> <p>Parts must not contain moulded-in or glued-on metal inserts unless they can be removed with commonly available tools. Disassembly instructions must show how to remove them.</p> <p>Verification:</p> <p>The tenderer must detail the tools required to remove any plastic parts containing metal inserts. Visual evidence must be provided to support compliance. Equipment holding a relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.</p>
	<p>TS23(b) Recyclability of plastic casings, enclosures and bezels</p> <p>The presence of paints and coatings must not significantly impact upon the resilience of plastic recycle produced from these components upon recycling and when tested according to ISO 180⁵⁴ or equivalent.</p> <p>Verification:</p> <p>The tenderer must provide valid mechanical/physical test reports carried out according to ISO 180 or equivalent. Third party test reports obtained from plastics recyclers, resin manufacturers or independent pilot tests must be accepted. Equipment holding a relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.</p>
	<p>New! TS24 Plastic composition recyclability</p> <p>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.</p> <p>Verification:</p> <p>The tenderer must provide a list of the plastic parts > 25g including the resin type used and its compatibility with recycling.</p> <p>If the plastic part > 25g is made from a blend of resins, the tenderer must provide 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 contracted/associated with the manufacturer or contracted with a trade organization), confirming the resin blend does not negatively impact the recyclability of the plastic.</p> <p>Equipment holding a relevant Type I Eco-label fulfilling the specified requirements will be deemed to comply.</p>

⁵⁴ For the purposes of this criterion a significant impact is defined as a >25% reduction in the notched izod impact of a recycled resin as measured using ISO 180.

TS25. Marking of plastic casings, enclosures and bezels

External plastic casings, enclosures and bezels with a weight greater than 50 grams must be marked in accordance with ISO 11469 and ISO 1043-1. 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.

TS25. Marking of plastic casings, enclosures and bezels

External plastic casings, enclosures and bezels with a weight greater than 25 grams (5 grams for smartphones) must be marked in accordance with ISO 11469 and ISO 1043-1. 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.

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.

New! TS26 Battery packs marking for the correct identification of their chemistry*Applicable to mobile equipment*

Battery packs and cells (including those incorporated into battery packs) must be marked with marking symbols for the correct identification of their chemistry. The marking symbol must be durable and legible and in line with the requirements of the IEC 62902:2019

Indication of the all metals (e.g. cobalt, nickel, lithium, etc.) with >1% in mass percentage ranges, as 1-2%, 2-5%, 5-10%. Referring to cell only or battery pack, which would include the charging electronics as well.

Verification

The tenderer must provide attestation of conformity from independent certification bodies.

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

<p>New! TS27 Declaration of Critical Raw Materials</p> <p>The tenderer must provide an 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:</p> <ul style="list-style-type: none"> a) Cobalt (present in batteries) b) Neodymium and other rare earth elements (present in HDD) c) Indium (present in display panels) d) Tungsten (present in vibration module) e) Palladium (present in PCBs) <p>Verification:</p> <p>The tenderer must provide a declaration identifying the CRMs that are present together with the indicative weight range and the corresponding part.</p>	
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2.4.1.1 *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, TS25a and TS25b, 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.

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 25g. 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 Angel 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 12.

Table 12 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 cm ² Comprehensive: Weight greater than 25 grams for tablet and portable all-in-one notebooks and 100 grams for computers and monitors and in all cases a surface area greater than 50 cm ²	Core: ISO 11469 and ISO 1043 section 1 Comprehensive: ISO 11469 and ISO 1043, sections 1-4
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 mm ²	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
Draft revised EU 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,	Weight heavier than 50 grams	'Appropriate standard symbols or abbreviated terms set between the punctuation marks '>' and '<' as specified in available standards.

	Components	Weight / size of plastic parts for which the requirements apply	Marking reference
	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.		

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 is 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.

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 13. The proposed criterion request the tenderers to provide a document declaring the indicative weight range of the CRM that are present in the parts listed in Table 13 that apply to their product.

Table 13 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
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2.4.1.2 *Comments from the 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 *Discussion points in preparation of the AHWG meeting*

Discussion points proposal

- | |
|--|
| <ul style="list-style-type: none"> • List of CRM present in ICT equipment and thresholds to report their presence |
|--|

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 14 End of life management current criteria (2016) and TR v1.0I**

GPP 2016	TR v1.0 Proposal
<i>TS1. Secure computer collection, sanitisation, re-use and recycling</i>	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	

First criteria proposal	
Core criteria	Comprehensive criteria
SUBJECT MATTER	
Procurement of end-of-life management services for Computers and Monitors	
TECHNICAL SPECIFICATION	
TS28. Secure computer collection, sanitisation, re-use and recycling	
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:	
<ul style="list-style-type: none"> - 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-use⁵⁵;
- 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 cm²,
- 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 T30

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

⁵⁵ 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.

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:

- 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 scheme⁵⁶.

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 TS30 is formulated in a way going beyond WEEE to further enhance recycling 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.

⁵⁶ 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'

2.4.3.2 *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.

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.

ANNEX I: MINIMUM ENERGY PERFORMANCE FOR COMPUTERS: CORE CRITERIA THRESHOLDS

Calculated Typical Energy Consumption (ETEC) for Desktop, Integrated Desktop, and Notebook Computers per Equation 1 shall be less than or equal to the maximum TEC requirement (ETEC_MAX) per Equation below:

$$\text{ETEC_MAX} = (1 + \text{ALLOWANCE}_{\text{PSU}}) \times (\text{TEC}_{\text{BASE}} + \text{TEC}_{\text{MEMORY}} + \text{TEC}_{\text{GRAPHICS}} + \text{TEC}_{\text{STORAGE}} + \text{TEC}_{\text{INT_DISPLAY}} + \text{TEC}_{\text{SWITCHABLE}} + \text{TEC}_{\text{EEE}})$$

Where:

- **ALLOWANCE_{PSU}** is an allowance provided to power supplies that meet the optional more stringent efficiency levels specified in Table 15; power supplies that do not meet the requirements receive an allowance of 0;
- **TEC_{BASE}** is the Base allowance specified in Table 16; and,
- **TEC_{GRAPHICS}** is the discrete graphics allowance as specified in Table 17, 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}**, and **TEC_{EEE}** are adder allowances as specified in Table 7

Table 15: 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	0.81	0.85	0.88	0.85	-	0.015
		0.84	0.87	0.90	0.87	-	0.03
	Integrated Desktop	0.81	0.85	0.88	0.85	-	0.015
		0.84	0.87	0.90	0.87	-	0.04
EPS	Notebook or desktop	0.83	-	-	-	0.88	0.015
		0.84	-	-	-	0.89	0.03
	Integrated Desktop	0.83	-	-	-	0.88	0.015
		0.84	-	-	-	0.89	0.04

Table 16: Base TEC Allowances

Category Name	Graphic Capability	Desktop or Integrated Desktop		Notebooks	
		Performance Score, P ^V	Base Allowance	Performance Score, P ^V	Base Allowance
0	Any Graphics dGfx≤G7	P≤3	69.0	P≤2	14.0
I1	Integrated or Switchable Graphics	3<P≤6	112.0	2<P≤5.2	22.0
I2		6<P≤7	120.0	5.2<P≤8	24.0
I3		P>7	135.0	P>8	28.0
D1	Discrete Graphics dGfx≤G7	3<P≤9	115.0	2<P≤9	16.0
D2		P>9	135.0	P>9	18.0

Table 17: Functional Adder Allowances for Desktop, Integrated Desktop, Thin Client and Notebooks Computers

Function		Desktop	Integrated Desktop	Notebook
TEC_{MEMORY}(kWh)^{vi}		0.8		
TEC_{GRAPHICS}(kWh)^{vii}	Graphics Category^{viii}	G1 <i>(FB_BW ≤ 16)</i>	36	14
		G2 <i>(16 < FB_BW ≤ 32)</i>	51	20
		G3 <i>(32 < FB_BW ≤ 64)</i>	64	26
		G4 <i>(64 < FB_BW ≤ 96)</i>	83	32
		G5 <i>(96 < FB_BW ≤ 128)</i>	105	42
		G6 <i>(FB_BW > 128; Frame Buffer Data Width < 192 bits)</i>	115	48
		G7 <i>(FB_BW > 128; Frame Buffer Data Width ≥ 192 bits)</i>	130	60
TEC SWITCHABLE (kWh)		0.5 x G1		N/A
TEC_{EEEE} (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)

$$\text{EP} = \begin{cases} 0, & \text{No Enhanced Power Displays} \\ 0.3 & \text{Enhanced Performance Display } d < 27 \\ 0.75 & \text{Enhanced Performance Display } d \geq 27 \end{cases}$$

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] x Frame Buffer Data Width [bits]) / (8 x 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 Equation 3; r is the Screen resolution in megapixels; and A is viewable screen area in square inches.

ANNEX II: MINIMUM ENERGY PERFORMANCE FOR COMPUTERS: COMPREHENSIVE CRITERIA THRESHOLDS

Calculated Typical Energy Consumption (E_{TEC}) for Desktop, Integrated Desktop, and Notebook Computers per Equation 1 shall be less than or equal to the maximum TEC requirement (E_{TEC_MAX}) per Equation below:

$$E_{TEC_MAX} = (1 + ALLOWANCE_{PSU}) \times (TEC_{BASE} + TEC_{MEMORY} + TEC_{GRAPHICS} + TEC_{STORAGE} + TEC_{INT_DISPLAY} + TEC_{SWITCHABLE} + TEC_{EEE})$$

Where:

- **ALLOWANCE_{PSU}** is an allowance provided to power supplies that meet the optional more stringent efficiency levels specified in Table 18; power supplies that do not meet the requirements receive an allowance of 0;
- **TEC_{BASE}** is the Base allowance specified in Table 19; and,
- **TEC_{GRAPHICS}** is the discrete graphics allowance as specified in Table 20, 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}**, and **TEC_{EEE}** are added allowances as specified in Table 7

Table 18: 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 19 Base TEC (TEC_{BASE}) Allowances for Desktop and Notebooks

Category Name	Graphic Capability	Desktop or Integrated Desktop	
		Performance Score, P^V	Base Allowance
0	Any Graphics $dGfx \leq G7$	$P \leq 3$	69.0
I1	Integrated or Switchable Graphics	$3 < P \leq 6$	112.0
I2		$6 < P \leq 7$	120.0
I3		$P > 7$	135.0
D1	Discrete Graphics $dGfx \leq G7$	$3 < P \leq 9$	115.0
D2		$P > 9$	135.0
Category Name	Notebooks		
	Performance Score, P^V	Base Allowance	
0	$P \leq 2$	6.5	
I1	$2 < P \leq 5.2$	22.0	
I2	$5.2 < P \leq 8$	8.0	
I3	$P > 8$	14.0	

Table 20: 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 <i>(FB_BW ≤ 16)</i>	36	29.3 x tanh (0.0038 x FB_BW – 0.137) + 13.4
		G2 <i>(16 < FB_BW ≤ 32)</i>	51	
		G3 <i>(32 < FB_BW ≤ 64)</i>	64	
		G4 <i>(64 < FB_BW ≤ 96)</i>	83	
		G5 <i>(96 < FB_BW ≤ 128)</i>	105	
		G6 <i>(FB_BW > 128; Frame Buffer Data Width < 192 bits)</i>	115	
		G7 <i>(FB_BW > 128; Frame Buffer Data Width ≥ 192 bits)</i>	130	
TEC SWITCHABLE (kWh)		0.5 x G1		N/A
TEC_{EEEE} (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)

$$EP = \begin{cases} 0, & \text{No Enhanced Power Displays} \\ 0.3 & \text{Enhanced Performance Display } d < 27 \\ 0.75 & \text{Enhanced Performance Display } d \geq 27 \end{cases}$$

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: $(Data\ Rate\ [Mhz] \times Frame\ Buffer\ Data\ Width\ [bits]) / (8 \times 1000)$

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 Equation 3; r is the Screen resolution in megapixels; and A is viewable screen area in square inches.

ANNEX III: 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)	<i>CORE CRITERIA</i> 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:	<i>AWARD CRITERIA</i> The notebook or tablet must be dropped from: a minimum of 76 cm (30 inches⁵⁷) 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: <ul style="list-style-type: none">• High temperature Storage $\geq 60\text{ }^{\circ}\text{C}$• Low temperature Storage $\leq -30\text{ }^{\circ}\text{C}$ The mobile equipment must be subjected to test cycles of a minimum of 4 hour for operational temperature at: <ul style="list-style-type: none">• Operational temperature $\geq 40\text{ }^{\circ}\text{C}$• Operational temperature $\leq -20\text{ }^{\circ}\text{C}$		
Screen resilience	The test equipment and setup used must be confirmed by the tenderer.	With the product placed on a flat surface two loading tests must be carried out: 1. A minimum load of 50kg must be evenly applied to the screen lid (for notebooks) or screen (for tablets).		

⁵⁷ US Department of Defence standard MIL-STD-810G Method 516.6 Specification VI 'Transit drop test'

			2. 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		<i>Minimum specification:</i> 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 or MIL-STD-810G Method 510.5, Procedure I Sand and dust - Blowing dust		IP-6x - No ingress of dust; complete protection against contact;	
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;	

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