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COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT REPORT

Accompanying the documents

Commission Regulation

laying down ecodesign requirements for smartphones, mobile phones other than smartphones, cordless phones and slate tablets pursuant to Directive 2009/125/EC of the European Parliament and of the Council and amending Commission Regulation (EU) 2023/826

and

Commission Delegated Regulation

supplementing Regulation (EU) 2017/1369 of the European Parliament and of the Council with regard to the energy labelling of smartphones and slate tablets

{C(2023) 1672 final} - {C(2023) 3538 final} - {SEC(2023) 164 final} -
{SWD(2023) 102 final}

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Annex 6: Articulation with other initiatives

At the time of the drafting of the current impact assessment (Q3 2021), a number of legislative and non-legislative initiatives was under development/already developed by the European Commission in fields related to product policy, circular economy and consumer rights:

1. Ecodesign for Sustainable Products Regulation[125];
2. Empowering consumers for the green transition[127]
3. Circular Electronics Initiative;
4. Promoting sustainability in consumer after-sales and a new consumer right to repair
5. Common charging solution initiative[1];
6. Review of the Commission Regulation (EU) No 617/2013 of 26 June 2013 on ecodesign requirements for computers and computer servers[128];
7. EU green public procurement criteria for computers, monitors, tablets and smartphones;
8. Intellectual property – review of EU rules on industrial design[2];
9. (proposal for a) Battery Regulation (European Commission, 2020b)

These initiatives could have potential relationships with the initiatives in support of which the current impact assessment is carried out, i.e. 'Designing mobile phones and tablets to be sustainable – ecodesign'[64] and 'Energy labelling of mobile phones and tablets – informing consumers about environmental impact'[70].

This annex presents and describes the articulation of the two initiatives on the Ecodesign and Energy Labelling of mobile phones and tablets with the other ones under preparation. The aim is to prevent duplication, so as to minimise the administrative burden for economic operators and authorities, and to show the potential synergic actions among different legislative and non-legislative tools.

In the remainder of this annex each of the abovementioned initiatives is briefly described, together with the articulation with the Ecodesign and Energy Labelling of mobile phones and tablets.

1	**Ecodesign for Sustainable Products Regulation[3]**
Legislative or non-legislative?	Legislative.

[1] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/2020-Standard-chargers-for-mobile-phones_en

[2] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12610-Intellectual-property-review-of-EU-rules-on-industrial-design-Design-Regulation-_en

[3] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12567-Sustainable-products-initiative_en

Brief description	This initiative, which will revise the Ecodesign Directive and propose additional legislative measures as appropriate, aims to make products placed on the EU market more sustainable. Consumers, the environment and the climate will benefit from products that are more durable, reusable, repairable, recyclable, and energy-efficient. The initiative will also address the presence of harmful chemicals in products such as: - electronics & ICT equipment; - textiles; - furniture; - steel & chemicals.
Interaction with the two initiatives on the Ecodesign and Energy Labelling of mobile phones and tablets	The two initiatives on the Ecodesign and Energy Labelling of mobile phones and tablets would consist in secondary legislation implementing the Ecodesign Directive 2009/125 and the Energy Labelling Regulation 2017/1369. Ecodesign Regulations are typically to be reviewed every 5 years (the specific time range varies case by case and is foreseen in the 'review clause' article of each Regulation). As the Ecodesign for Sustainable Products Regulation consists in the revised Ecodesign Directive, this would somehow affect all the products that will be, at the time of the finalisation of the review, already regulated under Ecodesign implementing Regulations. The impact assessment in support of the Ecodesign for Sustainable Products Regulation elaborates further on how the reviews of already existing Ecodesign Regulations could be carried out. *Why acting now with the Ecodesign and Energy Labelling of mobile phones and tablets?* The adoption of the measures on the Ecodesign and Energy Labelling of mobile phones and tablets is foreseen within the first half of 2022. This very ambitious timing[4] rests on the following reasons/motivations: - the commitments and deadlines of the Circular Economy Action Plan 2020, and in particular of the Circular Electronics Initiative; - the increasingly perceived importance of circular economy and ecodesign of products by consumers, in particular mobile phones; - postponing the Ecodesign and Energy Labelling requirements – for whatever procedural or policy aspects - in the short-middle term (e.g. 3 years) would leave unreaped environmental benefits. Within the Ecodesign preparatory study on mobile phones and tablets (European Commission 2021) it has been estimated that, only considering smartphones, as an effect of the first 3 years following the introduction of the Ecodesign and Energy Labelling requirements, 20TWh of energy would cumulatively be saved - EU member states already started proposing national regulatory initiatives in the field of the circular economy of mobile phones and tablets. For instance, from 1 January 2021 manufacturers, importers, marketers and other retailers that put smartphones (as well as laptops and other products) on the French market have to inform, free of charge,

[4] From the start of the preparatory study in March 2020, until publication of the Regulations on the Official Journal of the European Union in September 2022, there would be 30 months. The European Court of Auditors estimated the duration of the theoretical regulatory process for adopting implementing measures under the Ecodesign and energy-labelling framework in the order of 40-42 months, with examples of measures taking up to 96 months to come to finalisation.

	downstream sellers and any person of the reparability index of their products. Without harmonised EU legislation in the field, a jeopardised internal market for these products could be expected in the next years.
2	**Empowering consumers for the green transition**[5]
Legislative or non-legislative?	Legislative.
Brief description	This initiative will tackle problems identified with: o consumer information aspects at the point of sale, in particular the fact that consumers lack reliable information for choosing more environmentally sustainable products, including related to the durability and reparability of products; o protecting consumers against certain unfair commercial practices in relation to sustainable purchasing, such as greenwashing, early obsolescence of consumer goods and non-transparent sustainability labels or digital tools. It will apply in a business-to-consumer context. The IA assessed policy options building upon the existing EU horizontal consumer law framework[9], including the improvements recently brought forward in relation to enforcement[10]. It will result in targeted amendments by "greening" existing consumer law (i.e. the Consumer Rights Directive and the Unfair Commercial Practices Directive). The proposal was adopted by the Commission on 30 March 2022.
Interaction with the two initiatives on the Ecodesign and Energy Labelling of mobile phones and tablets	The initiative on Empowering Consumers for the Green Transition will aim, inter alia, to improve information on the durability and reparability of products at the point of sale, in particular by setting horizontal information requirements through consumer law, and by laying down a general obligation on sellers to provide consumers, at the point of sale, with a Repair Scoring Index, when such a score is established in accordance with EU law for the relevant product group. It also aims to provide better consumer protection against misleading practices leading them away from sustainable purchases such as early obsolescence practices. The two initiatives on the Ecodesign and Energy Labelling of mobile phones and tablets, by laying down specific product requirements, will be able to elaborate on and further complement the above general obligations, in particular in relation to the reparability and durability of products. For example, by establishing a Reparability Scoring Index at EU level for mobile phones and tablets, these initiatives will directly complement the requirement in the initiative on Empowering Consumers for the Green Transition that a Reparability Scoring Index needs to be provided to a consumer at the point of sale whenever this is established by EU law.

5 https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12467-Consumer-policy-strengthening-the-role-of-consumers-in-the-green-transition_en

3	**Circular Electronics Initiative (CEI)**
Legislative or non-legislative?	Non-legislative initiative (TBD) + legislative initiative (TBD).
Brief description	The objectives of the circular electronics initiative (CEI) are to extend the lifespan of electronic devices (starting with mobile phones, tablets and laptops) to reduce e-waste, retain rare/valuable materials, improve recycling and boost European aftermarkets. To achieve this, these devices must be designed to be durable and allow for disassembly, maintenance, repair, reuse and recycling, and consumers should have a right to repair them (including a right to software updates). To meet these commitments, a two-pronged approach is currently envisaged. Upstream requirements need to be in place in order to ensure these devices are reparable and durable by design. On the demand-side, the CEI aims to ensure devices cannot only technically be repaired but that consumers have easy/affordable access to repair.
Interaction with the two initiatives on the Ecodesign and Energy Labelling of mobile phones and tablets	The CEI, as currently envisaged, consists of a number of actions to increase the sustainability of consumer electronics. The two initiatives on the Ecodesign and Energy Labelling of mobile phones and tablets are an integral part of the CEI, as they represent one of the prongs of the CEI, namely upstream/supply-side requirements to ensure reparability and durability by design, as well as provisions for the availability of spare parts and software updates.

4	**Promoting sustainability in consumer after-sales and a new consumer right to repair - Right to Repair**
Legislative	Legislative initiative (Q3 2022).
Brief description	This initiative would encourage goods being used for a longer time, more defective goods being repaired, and more second-hand goods being purchased. It would encourage consumers in an after-sales context to repair a product when it is defective. It would also encourage producers to design their goods in such a way that they last longer, would be easily reparable and to take better into consideration their use/reuse phase. The initiative could entail a package of targeted amendments of the Sale of Goods Directive and a new instrument on a right to repair. The Sale of Goods Directive could be amended for situations when consumers receive defective goods in sales transactions. Currently, according to the Directive, when sellers deliver defective goods, consumers have a choice between the repair of the defective product and the replacement with a new one during a liability period of at least two years. There are several options how to increase sustainability through targeted amendments of the SGD which will be examined in detail in the impact assessment. Among those options are the following: Consumers could be incentivised to opt for the more sustainable alternative of repair, for instance by restarting anew the liability period after repair.

	To further promote sustainable decisions, consumers could be stimulated to buy second-hand goods instead of new ones, for instance by aligning the liability period for second-hand goods with that of new ones. To encourage producers to produce goods which last longer, the liability period could be extended. A new instrument on a right to repair could create a consumer right to have a defective product repaired, probably by the producer, within a given period after purchase and for a reasonable cost. While the Sale of Goods Directive would continue to apply to defects which already existed at the time of delivery, the new instrument could apply to other defects, for example those due to the use of the goods or to a lack of conformity which becomes manifest after the liability period of the Directive.
Interaction with the two initiatives on the Ecodesign and Energy Labelling of mobile phones and tablets	The two initiatives on the Ecodesign and Energy Labelling of mobile phones and tablets are an integral part of the CEI and will, in relation to repair, address the supply side by setting out quantitative and information requirements for products placed on the market. The initiative on 'Promoting sustainability in consumer after-sales and a new consumer right to repair' could help to further address the demand side by providing incentives and tools for consumers to play their part in a more sustainable consumption by fighting the premature disposal of goods before the end of their useful life. The three initiatives would be complementary and produce synergies. For example, the scope and content features of the right to repair could be linked with the Ecodesign and Energy Labelling requirements on mobile phones and tablets. As a result, more use would be made of the repair option created through supply side measures. Vice versa, the supply side measures are a prerequisite for a right to repair as only repairable goods can actually be repaired.

5	**Common charging solution for mobile telephones and other similar devices**[123]
Legislative or non-legislative?	Legislative.
Brief description	This initiative aims to limit fragmentation of the charging solutions, at the same time not hampering future technological evolution. The specific objectives are as follows: 1. To promote interoperability reducing the fragmentation in terms of end-device charging port of mobile phones and other portable devices; 2. To promote interoperability in terms of charging performance of devices. The devices shall unjustifiably reduce the charging performance below the maximum level that they both support and ensure that fast charging can work irrelevant of the charger used; 3. To ensure citizens have enough information as to make informed choices when they decide to buy a new device. Consumers shall be given clear, intelligible and immediate tool to understand the performance of the electronic devices and which charging accessories shall be used to achieve the optimal performance;

	4. To provide consumers with a choice as to whether they want to acquire a new charger when they purchase electronic devices; 5. The pool of devices in scope of the initiative is to be extended to the maximum possible, in the respect of the charging requirements, technologies and uses. Radio equipment, such as data-enabled mobile telephones fall within the scope of the Radio Equipment Directive (RED) 2014/53/EU. Actually, Art. 3(3)(a) of RED, that states: "[…] Radio equipment within certain categories or classes shall be so constructed that it complies with the following essential requirements: (a) radio equipment interworks with accessories, in particular with common chargers […]'' empowers the Commission to impose harmonised solutions. This will be amended by the new proposal for a revision of the RED which will set new requirements as regards to interoperability with 'common' chargers.
Interaction with the two initiatives on the Ecodesign and Energy Labelling of mobile phones and tablets	The common charging solution initiative proposes actions on the side of mobile phones and similar portable devices. Mobile phones are also in scope to the two initiatives on the Ecodesign and Energy Labelling of mobile phones and tablets. The close cooperation between Commission services ensures that there will be no points of overlap between the three initiatives, with provisions under each of the 3 pieces of legislation (RED Directive, Ecodesign Directive and Energy Labelling Regulation) specifically target to the specific objectives – and legal remit – of each initiative. There is rather a potential for synergic action. For example, under consideration for the formulation of the Ecodesign requirements on the availability of chargers as spare parts there is an exemption for smartphones compliant with the new requirements of the Common Charging Solution initiative.

6	**Review of the Commission Regulation (EU) No 617/2013 of 26 June 2013 on ecodesign requirements for computers and computer servers[6]**
Legislative or non-legislative?	Legislative.
Brief description	Computers and small servers sold in the EU are subject to ecodesign rules, as outlined in Regulation (EU) No 617/2013. They cap estimated annual energy consumption based on a product's average use pattern. They also include requirements for the efficiency of the internal power supply and power management. It has been estimated that switching to products that comply with these ecodesign requirements led to electricity savings of up to 16.3 TWh by 2020, equivalent to cost savings for European citizens of up to EUR 2.6 billion. This Regulation is under review. The technology and market changes that has occurred since the initial preparatory study on Lot 3 concluded in 2007 (in support to the current Regulation) are being assessed. The scope of the Regulation is being revised, and a number of new aspects (in particular: potential circular economy requirements) are being analysed.
Interaction with the two initiatives on the Ecodesign and Energy Labelling of	A detailed analysis on the differences between the scope of the Ecodesign Regulation 617/2013 and the scope of the (potential) Ecodesign Regulation on mobile phones and tablets is presented at the beginning of Annex 9.

[6] OJ L 175, 27.6.2013, p. 13–33.

mobile phones and tablets	

7	**EU Green Public Criteria for Computers, Monitors, Tablets and Smartphones**
Legislative or non-legislative?	Non-legislative – Voluntary Guidance published as Staff Working Document of the European Commission.
Brief description	The Staff Working Document SWD (2021) 57 provides the EU Green Public Criteria for Computers, Monitors, Tablets and Smartphones. These EU GPP Criteria aim 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. These criteria for computers, monitors, tablets and smartphones focus on the most significant environmental impacts during their life cycle, which have been divided into four distinct areas: product lifetime extension; energy consumption; hazardous substances; end-of-life management. This set of criteria also includes a further category of criteria that apply to separate procurements for refurbished/remanufactured devices and related services.
Interaction with the two initiatives on the Ecodesign and Energy Labelling of mobile phones and tablets	The two initiatives are potentially synergic. Some of the EU GPP Criteria anticipate (at voluntary level), requirements are thresholds that are proposed for a mandatory implementation, at a late stage, under the Ecodesign. The EU GPP Criteria have already included, among others, criteria on battery endurance (in cycles), water and dust ingress protection, free fall testing, reparability, spare parts availability, unbundling of accessories, for both smartphones and tablets. The EU public sector can drive and stimulate the market toward a rapid and smooth implementation of these aspects at mandatory level.

8	**Intellectual property – review of EU rules on industrial design**
Legislative or non-legislative?	Legislative.
Brief description	This initiative will update EU rules on design protection. Design rights protect the appearance of a product, which results from attributes such as its shape, colours or materials, from unauthorised use. The initiative aims to: - modernise, clarify and strengthen design protection; - make design protection more accessible and affordable across the EU; - ensure EU and national rules governing design protection are more compatible; - further align EU rules on design protection for repair spare parts.
Interaction with the two initiatives on the Ecodesign and Energy Labelling of	The policy option(s) currently under investigation for the EU rules on design protection for repair spare parts (in particular, that the market of 'must-match' spare parts should be opened for competition in entire EU, extending it to both existing and new designs) would be synergic with the initiative on the Ecodesign

mobile phones and tablets	of mobile phones and tablets, in particular for the Ecodesign requirements on reparability aspects.

9	**(proposal for a) Battery Regulation (European Commission, 2020b)**
Legislative or non-legislative?	Legislative.
Brief description	This Regulation aims to ensure that batteries placed in the EU market are sustainable and safe throughout their entire life cycle. The Commission proposes a range of mandatory requirements for various categories of batteries (i.e. industrial, automotive, electric vehicle and portable) placed on the EU market. Requirements such as use of responsibly sourced materials with restricted use of hazardous substances, minimum content of recycled materials, carbon footprint, performance and durability and labelling, as well as meeting collection and recycling targets, are essential for the development of more sustainable and competitive battery industry across Europe and around the world.
Interaction with the two initiatives on the Ecodesign and Energy Labelling of mobile phones and tablets	The initiatives are synergic. The "placing on the market" provisions of the Batteries proposal address mainly the large batteries (electric vehicle and industrial battery with capacity above 2 kWh) and portable batteries of general use (battery formats such as AA, AAA etc. that exist in both rechargeable and no-rechargeable forms), because it was not considered feasible in such legislative framework to regulate every application of batteries (e.g. performance and durability of smart phone batteries) or for certain requirements not proportionate (carbon footprint, recycled content and supply chain due diligence). The key provisions of the Batteries proposal that apply to batteries contained in mobile phones and tablets are the following: - Chapter VII, on end-of-life that deals with collection, treatment, recycling and recovery of waste batteries and the minerals contained in them. The ecodesign and energy labelling measures considered here do not deal with such activities; - Article 6, on restrictions of hazardous chemicals. It is not the intention to do so for the Ecodesign of mobile phones and tablets, because existing legislation already addresses this (Batteries Directive, RoHS Directive, REACH Regulation); - Article 11, which requires that portable batteries (i.e. batteries less than 5 kg) incorporated in appliances can be removed and replaced. The Ecodesign requirement on the disassemblability of batteries (described in detail under Annex 9) is in line with this provisions, and it could be considered as *lex specialis*[7] related to the batteries of mobile phones and tablets. It addresses in greater detail the proposed Battery Regulation's general requirement for removability and replaceability. The batteries proposal can regulate this aspect only in a general way and without specific conformity provisions for economic operators and market surveillance authorities, because such conformity assessment will effectively have to be done by appliance manufacturers rather than battery manufacturers. - Concerning the information requirements foreseen under the Battery Regulation and the Ecodesign Regulation: o Article 13 of the Battery Regulation concerns the labelling of the battery. This will provide basic information about the battery (manufacturer, type, chemistry) and its capacity. The indication about the battery chemistry would give information on whether

[7] It should be noted that the proposed Battery Regulationhas not yet been adopted by the European Parliament and the Council.

	it includes cobalt or not. Such information requirements are not foreseen for the initiative on the Ecodesign Regulation. o This initiative includes Ecodesign information requirements affecting the batteries of mobile phones and tablets, related to the interaction of the battery with the phone/tablet (in particular, they concern the battery maintenance and the battery management system). These information requirements are not foreseen by the Battery Regulation for this category of batteries. Thus, there is no overlap between the sets of information requirements of the Battery proposal and the Ecodesign regulation for mobile phones and tablets.

Annex 7: The Ecodesign Directive 2009/125, the Energy Labelling Regulation and the product-specific measures

In the European Union (EU), the Ecodesign Directive[8] requires product manufacturers to improve the environmental performance of their products by meeting minimum energy efficiency requirements, as well as other environmental requirements such as water consumption, emission levels or minimum durability of certain components or requirements on reparability (including upgrades), recyclability, ease of reuse and end-of-life treatment before they can place their products on the market. The Energy Labelling Regulation[9] complements Ecodesign by enabling end-consumers to identify the better-performing products, via the well-known A-G/green-to-red labelling grading.

Together with the Energy Labelling Regulation, this legislative framework pushes industry to improve the energy efficiency of products and removes the worst-performing ones from the market. It also helps consumers and companies to reduce their energy bills. In the industrial and services sectors, this results in support to competitiveness and innovation. Finally, it ensures that manufacturers and importers responsible for placing products on the European Union (EU) market only have to comply with EU-wide rules, instead of Member State legislation. Some of its main achievements are highlighted below.

[8] Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products

[9] Regulation (EU) 2017/1369 setting a framework for energy labelling and repealing Directive 2010/30/EU

This legislative framework benefits from broad support from European industries[10], consumers[11], environmental non-governmental organisations (NGOs)[12,13] and Member States (MSs), because of its positive effects on innovation, increased information for consumers and lower costs, as well as environmental benefits.

Ecodesign and energy labelling are recognised globally as one of the most effective policy tools in the area of energy efficiency. They are central to making Europe more energy efficient, contributing in particular to the 'Energy Union Framework Strategy'[14], and to the priority of a 'Deeper and fairer internal market with a strengthened industrial base'[15]. The 2030 Climate Target Plan[16] notes that EU product efficiency standards have reduced their energy needs by about 15% and cut EU GHG emissions by 7%, while creating many additional jobs.

In quantitative terms, it has been estimated that the average EU27 household in 2020:

- Bought 11 regulated products of which 4 light sources, 4 electronics products.
- Used 70 regulated products of which 30 light sources, 25 electronics products.
- Saved 1000 kWh (27%) of electricity and 700 kWh (6%) of fuel (gas, oil coal, wood) in2020 compared to a scenario without Ecodesign and Labelling measures. In 2030 this is projected to increase to 1200 kWh electricity (33%) and 1400 kWh of fuel (12%).
- Avoided 530 kg CO2eq of greenhouse gas emissions in 2020 compared a scenario without Ecodesign and Labelling measures. In 2030 this is projected to increase to almost 700 kg CO2eq/household.

[10] "[…] Our industry organisations, representing the heating, cooling, refrigeration, household appliance, commercial cleaning appliance and lighting sectors, strongly support Ecodesign and Energy Labelling which, for a number of product groups, have proven very successful and contributed to the EU's energy and climate goals by pushing and pulling the market towards more energy efficient products. […]", from the joint letter of 6 industry associations on ecodesign [https://www.applia-europe.eu/topics/121-joint-industry-letter-on-ecodesign]

[11] "How consumers benefit from ecodesign year after year", The European Consumer Organisation (BEUC), https://www.beuc.eu/publications/beuc-x-2016-109-benefits_of_ecodesign_for_eu_households_executive_summary.pdf

[12] Support Ecodesign and energy labels, NGOs tell Regulatory Scrutiny Board"[https://www.coolproducts.eu/policy/support-ecodesign-and-energy-labels-ngos-tell-regulatory-scrutiny-board/]

[13] "Environmental NGOs and repair groups call for a significant increase in resources dedicated to the development of EU Ecodesign and Energy Labelling policies" [https://www.coolproducts.eu/wp-content/uploads/2021/03/NGO-letter-on-ecodesign-delays.pdf]

[14] Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee, The Committee Of The Regions And The European Investment Bank - A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy. COM/2015/080 final. (Energy Union Framework Strategy)

[15] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - Upgrading the Single Market: more opportunities for people and business COM/2015/550 final. 28 October 2015. (Deeper and fairer internal market)

[16] COM(2020) 562 final, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0562

– Saved EUR 210 (7%) in user expenditure in 2020, expected to increase to EUR 350 per year per household in 2030 (11%) compared to a scenario without Ecodesign and Labelling measures. This considers only the direct savings for products used in households. Additional financial benefits for households might arrive from the savings in the tertiary and industry sectors, if these are translated in lower tariffs, lower product prices, or higher wages.

The Ecodesign Directive and Energy Labelling Regulation include a built-in proportionality and significance test. For the Ecodesign Framework Directive, Articles 15(1) and 15(2) state that a product should be covered by an ecodesign or a self-regulating measure if the following conditions are met:

- The product should represent a significant volume of sales;
- The product should have a significant environmental impact within the EU;
- The product should present a significant potential for improvement without entailing excessive costs, while taking into account:
    - an absence of other relevant Community legislation or failure of market forces to address the issue properly;
    - a wide disparity in environmental performance of products with equivalent functionality.

The procedure for preparing such measures is described in Article 15(3). In addition, the criteria of Article 15(5) should be met:

- No significant negative impacts on user functionality of the product;
- No significant negative impacts on Health, safety and environment;
- No significant negative impacts on affordability and life cycle costs;
- No significant negative impacts on industry's competitiveness (including SMEs).

The preparatory work prior to any Ecodesign or Energy labelling policy measure[17] entails technical as well as procedural and legal steps, according to a well-defined procedure, which is shown in the figure below.

[17] Ecodesign policy measures at product level (and, less frequently, as horizontal level, i.e. addressing several products groups) are usually in the form implementing regulations, derived from the "framework" Ecodesign Directive 2009/125/EC. Energy labelling policy measures are in the form of delegated regulations, derived from the "framework" Energy Labelling Regulation. The full list of the existing Ecodesign and Energy labelling measures can be found at https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-efficient-products

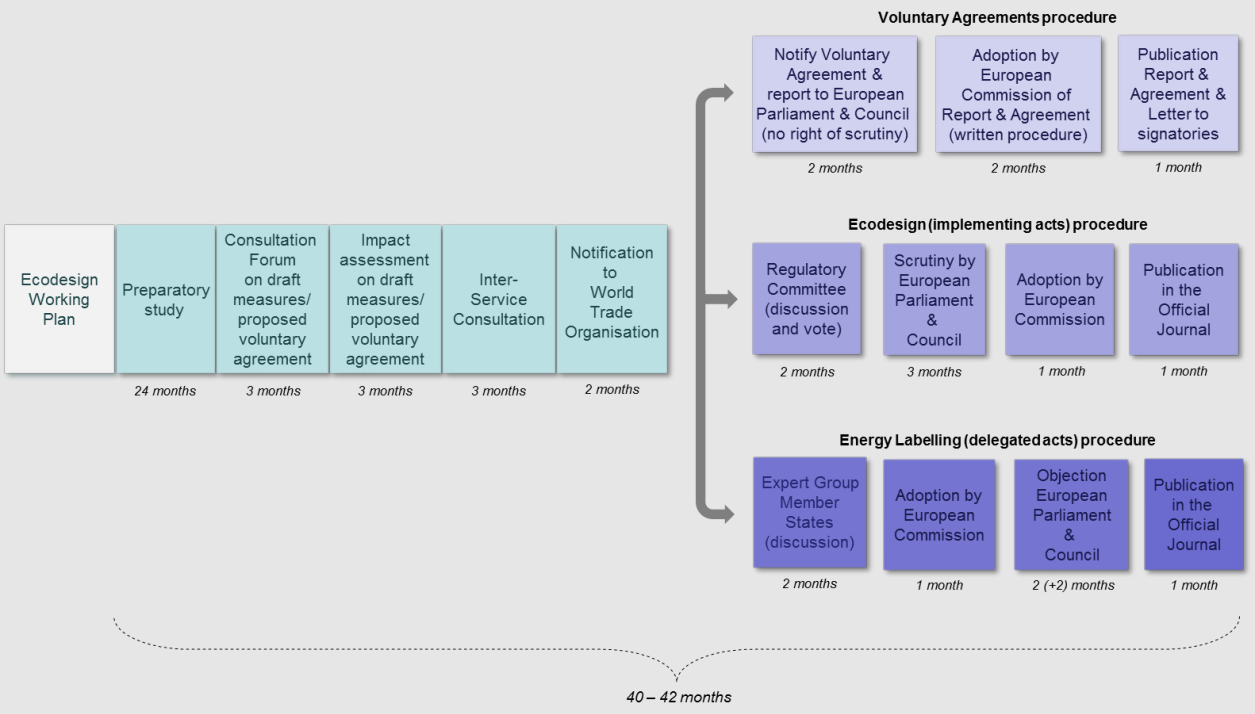


Figure 32: Procedure for developing Ecodesign implementing measures

Potential candidate-products, for which the feasibility of proposing Ecodesign (and/or Energy Labelling) requirements will be investigated in detail, are normally listed in the Ecodesign Working Plan, a document prepared by the European Commission every three to five years. An Ecodesign working plan sets out an indicative list of prioritised product groups, mainly on the basis of the criteria of the expected energy savings in case of regulatory measures. Historically, the main criterion to prioritize inclusion of product groups in the successive working plans has been the potential for energy saving by pushing for more efficient products[18].

Products listed in an Ecodesign working plan are first generally analysed in a preparatory study, which provides the necessary technical and economic information to orient more in-depth analysis. Once, for a specific product group, the conditions for action are met[19], an impact assessment takes place, where various policy options are analysed, such as "no action[20]", voluntary agreement, Ecodesign requirements at various levels of stringency, energy labelling schemes or other alternative policy tools. The options are compared across different impact dimensions (economic, occupational, social and environmental aspects, on top of environmental savings) in order to identify the best one. During the impact assessment phase, potential regulatory approaches are discussed in the context of a Consultation Forum meeting with the EU member states, industrial organizations, the ESOs (European Standardization Organizations) and the consumer organizations and environmental NGOs. This meeting is

[18] The last Ecodesign working plan 2016-19 also qualitatively assessed the material efficiency aspects.
[19] See article 15 of the Ecodesign Directive 2009/125/EC
[20] the "no action" scenario represents the business-as-usual condition, where the EU takes no initiative in terms of new regulatory measures

among the most important consultations throughout the whole procedure, as stakeholders' objective and external critical comments are extremely useful to improve the scoping of the measures, product definitions, wider considerations and detailed text, practicality of enforcement, etc. Subsequently, an internal consultation of all the interested European Commission services (known as 'inter-service consultation') takes place, a notification of an advanced draft is provided to the World Trade Organization for comments and, finally a Regulatory Committee vote (for Ecodesign) or an Expert meeting (for Energy Labelling) further amends the draft, before a formal adoption by the Commission and a scrutiny by EU Parliament and the Council. The Ecodesign Directive, in its article 17, also offers the opportunity to manufacturers to sign voluntary agreements, with the commitment to reduce the energy consumption of their products. When appropriate[21], the Commission formally recognises such agreements and monitors their implementation and abstains from regulatory measures.

Ecodesign Regulations typically foresee requirements (e.g. on minimum energy efficiency levels) which enter gradually in force following a two or three tiers scheme. The first tier is usually between one and three years after publication; the second usually applies after three-five years. Timing and stringency of each tier take into account the design cycle and the typical life-span of a specific product model. Ecodesign Regulations are typically reviewed within a certain number of years to cope with technology, market or legislative evolution. On top of their contribution to the energy efficiency objectives under the Energy Union strategy, since the adoption of the Circular Economy Action Plan in December 2015, Ecodesign regulations are also expected to contribute to the objectives on material efficiency and design for circularity.

As an alternative to regulation, the Ecodesign Directive states that priority should be given to alternative courses of action such as self-regulation by the industry where such action is likely to deliver the policy objectives faster or in a less costly manner than mandatory requirements. Self-regulation, including voluntary agreements offered as unilateral commitments by industry, can enable quick progress due to rapid and cost-effective implementation, and allows for flexible and appropriate adaptations to technological options and market sensitivities.

The European Commission assesses each self-regulatory initiative on a case-by-case basis after consulting the members of the Consultation Forum and taking into account the findings of the technical/economic preparatory study if available. The basis for the assessment whether a proposal goes beyond business-as-usual is the information provided by the industry and affected parties and, if available, the findings of the preparatory study. Voluntary agreements are expected to include quantified and staged objectives, starting from a well-defined baseline

[21] For the assessment of voluntary agreements presented as alternatives to implementing measures, information on at least the following issues should be available: openness of participation, added value, representativeness, quantified and staged objectives, involvement of civil society, monitoring and reporting, cost-effectiveness of administering a self-regulatory initiative and sustainability.

and measured through verifiable indicators. Voluntary agreements also need arrangements for independent verification as they are not necessarily subject to market surveillance by Member States.

Guidelines on self-regulation[22] were adopted by the European Commission on 30 November 2016.

To date, 32 Ecodesign Regulations and 2 voluntary agreements are in force. An overview of these measures can be found in the table below.

Table 17: Overview of applicable Ecodesign measures

	Ecodesign
Ecodesign framework	Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products.
Heaters	Council Directive 92/42/EEC of 21 May 1992 on efficiency requirements for new hot-water boilers fired with liquid or gaseous fuels (only Articles 7(2) and 8 and Annexes III to V). Commission Regulation (EU) No 813/2013 of 2 August 2013 with regard to ecodesign requirements for space heaters and combination heaters. Commission Regulation (EU) No 814/2013 of 2 August 2013 with regard to ecodesign requirements for water heaters and hot water storage tanks. Commission Regulation (EU) 2015/1185 of 24 April 2015 with regard to ecodesign requirements for solid fuel local space heaters. Commission Regulation (EU) 2015/1188 of 28 April 2015 with regard to ecodesign requirements for local space heaters. Commission Regulation (EU) 2015/1189 of 28 April 2015 with regard to ecodesign requirements for solid fuel boilers. Commission Regulation (EU) 2016/2281 of 30 November 2016 with regard to ecodesign requirements for air heating products, cooling products, high temperature process chillers and fan coil units.
Off mode & standby	Commission Regulation (EC) No 1275/2008 of 17 December 2008 with regard to ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment. Commission Regulation (EU) No 801/2013 of 22 August 2013 amending Regulation (EC) No 1275/2008 with regard to ecodesign requirements for standby, off mode electric power consumption of electrical and electronic household and office equipment, and amending Regulation (EC) No 642/2009 with regard to ecodesign requirements for televisions.
Lighting	From 1 September 2021:

[22] Commission Recommendation (EU) 2016/2125 of 30 November 2016 on guidelines for self-regulation measures concluded by industry under Directive 2009/125/EC of the European Parliament and of the Council; OJ L 329, 3.12.2016, p.109

	Commission Regulation (EU) 2019/2020 of 1 October 2019 laying down ecodesign requirements for light sources and separate control gears. Until 31 August 2021: Commission Regulation (EC) No 244/2009 of 18 March 2009 with regard to ecodesign requirements for non-directional household lamps. Commission Regulation (EC) No 245/2009 of 18 March 2009 with regard to ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps. Commission Regulation (EU) No 1194/2012 of 12 December 2012 with regard to ecodesign requirements for directional lamps, light emitting diode lamps and related equipment.
Refrigeration	Commission Regulation (EU) 2015/1095 of 5 May 2015 with regard to ecodesign requirements for professional refrigerated storage cabinets, blast cabinets, condensing units and process chillers. Commission Regulation (EU) 2019/2019 of 1 October 2019 laying down ecodesign requirements for refrigerating appliances. Commission Regulation (EU) 2019/2024 of 1 October 2019 laying down ecodesign requirements for refrigerating appliances with a direct sales function.
Washing machines & washer-dryers	Commission Regulation (EU) 2019/2023 of 1 October 2019 laying down ecodesign requirements for household washing machines and household washer-dryers.
Motors	From 1 July 2021: Commission Regulation (EU) 2019/1781 of 1 October 2019 laying down ecodesign requirements for electric motors and variable speed drives, amending Regulation (EC) No 641/2009 with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products. Until 30 June 2021: Commission Regulation (EC) No 640/2009 of 22 July 2009 with regard to ecodesign requirements for electric motors.
Circulators	Commission Regulation (EC) No 641/2009 of 22 July 2009 with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products. Commission Regulation (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No 641/2009 with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products. Commission Regulation (EU) 2019/1781 of 1 October 2019 laying down ecodesign requirements for electric motors and variable speed drives, amending Regulation (EC) No 641/2009 with regard to ecodesign

	requirements for glandless standalone circulators and glandless circulators integrated in products.
Water pumps	Commission Regulation (EU) No 547/2012 of 25 June 2012 with regard to ecodesign requirements for water pumps.
Tumble driers	Commission Regulation (EU) No 932/2012 of 3 October 2012 with regard to ecodesign requirements for household tumble driers.
Computers and servers	Commission Regulation (EU) No 617/2013 of 26 June 2013 with regard to ecodesign requirements for computers and computer servers. Commission Regulation (EU) 2019/424 of 15 March 2019 laying down ecodesign requirements for servers and data storage products amending Commission Regulation (EU) No 617/2013.
Vacuum cleaners	Commission Regulation (EU) No 666/2013 of 8 July 2013 with regard to ecodesign requirements for vacuum cleaners.
Electronic displays (including TVs)	Commission Regulation (EU) 2019/2021 of 1 October 2019 laying down ecodesign requirements for electronic displays.
External power supplies	Commission Regulation (EU) 2019/1782 of 1 October 2019 laying down ecodesign requirements for external power supplies.
Cooking appliances	Commission Regulation (EU) No 66/2014 of 14 January 2014 with regard to ecodesign requirements for domestic ovens, hobs and range hoods.
Power transformers	Commission Regulation (EU) No 548/2014 of 21 May 2014 with regard to small, medium and large power transformers. Commission Regulation (EU) 2019/1783 of 1 October 2019 amending Regulation (EU) No 548/2014 with regard to small, medium and large power transformers.
Air conditioners and fans (including ventilation units)	Commission Regulation (EU) No 206/2012 of 6 March 2012 with regard to ecodesign requirements for air conditioners and comfort fans. Commission Regulation (EU) No 327/2011 of 30 March 2011 with regard to ecodesign requirements for fans driven by motors with an electric input power between 125 W and 500 KW. Commission Regulation (EU) No 1253/2014 of 7 July 2014 with regard to ecodesign requirements for ventilation units. Commission Regulation (EU) 2016/2281 of 30 November 2016 with regard to ecodesign requirements for air heating products, cooling products, high temperature process chillers and fan coil units.
Dishwashers	Commission Regulation (EU) 2019/2022 of 1 October 2019 laying down ecodesign requirements for household dishwashers.

Welding equipment	Commission Regulation (EU) 2019/1784 of 1 October 2019 laying down ecodesign requirements for welding equipment.
Omnibus	Commission Regulation (EU) 2021/341 of 23 February 2021 amending Regulations (EU) 2019/424, (EU) 2019/1781, (EU) 2019/2019, (EU) 2019/2020, (EU) 2019/2021, (EU) 2019/2022, (EU) 2019/2023 and (EU) 2019/2024 with regard to ecodesign requirements for servers and data storage products, electric motors and variable speed drives, refrigerating appliances, light sources and separate control gears, electronic displays, household dishwashers, household washing machines and household washer-dryers and refrigerating appliances with a direct sales function.
Imaging equipment	Voluntary agreement – Report from the Commission to the European Parliament and the Council on the voluntary ecodesign scheme for imaging equipment COM/2013/023 final.
Game consoles	Voluntary agreement - Report from the Commission to the European Parliament and the Council on the voluntary ecodesign scheme for games consoles (COM/2015/0178 final).

Annex 8: A reparability scoring system for smartphones and tablets

Context

In support of a possible introduction of product reparability scoring in the EU policy, the JRC published a report in 2019 in which such a system is developed (hereinafter "General Method"). In that report, scoring criteria are set out to rate the extent to which products are reparable or upgradable. The assessment of reparability focuses on a number of priority product parts and technical parameters, which cover product design characteristics and relevant operational aspects, related to the repair and upgrade of products.

This work took place with the participation of a range of stakeholders, including member states, industry representatives, consumer and environmental NGO, who provided input in stakeholder meetings hosted by the JRC team. Furthermore, it expands on the methodological work conducted at the level of European standardisation, and specifically the development of standard EN 45554:2020.In parallel to the work at the EU level, a reparability scoring scheme has been introduced at the national level in France, while other member states such as Germany and Spain have highlighted the importance of establishing such system at EU level as well. Moreover, several mobile phone operators launched an industry-wide harmonised labelling scheme for mobile phones. In that sense, the establishment of such a system at EU level fills an identified information gap while avoiding a potential proliferation of national reparability schemes that would hinder development at a single market context. Despite the development of the French index, France continues to constructively participate at EU level discussions during the development of this report and the subsequent study for application in smartphones and slate tablets.

The study[23] at the basis of the development of the reparability scoring method for smartphones and tablets products uses the aforementioned JRC method developed in 2019 and follows the methodological steps and proceeds with the choices that are deemed appropriate for these product groups.

[23] https://susproc.jrc.ec.europa.eu/product-bureau/product-groups/447/home.

Figure 33: From general to product specific approaches

The selection and weighting of priority parts and the definition and weighting of the scoring criteria are based on the proposed regulation laying down ecodesign requirements for mobile phones, cordless phones and tablets. However, the scope of the reparability scoring system is limited to smartphones and slate tablets only and does not include a) mobile phones other than smartphones and b) cordless phones. As identified in the preparatory study, these product categories (i.e. mobile phones other than smartphones, and cordless phones) demonstrate different features and product characteristics compared to smartphones and tablets, such as easier disassembly by users and removable batteries, therefore a repair scoring system was deemed less relevant.

Selection and weighting of Priority Parts

A selection of relevant priority parts is made in order to maintain the complexity in the assessment at a reasonable level, and to ensure consistency with proposed ecodesign minimum requirements. The criteria used for the identification and weighting of those parts are primarily the functional importance of the part (i.e. the extent to which a part is necessary for the delivery of primary or secondary functions of the product), and the frequency of failure or update of a given part.

Based on the same factors, the priority parts were also weighted in order to influence the final score accordingly, as shown in the Table 18 below. Two scenarios are considered depending on the design of the product, i.e. whether the part of folding mechanism (part level 4) are present on the phone/tablet.

Table 18: Table: Selected priority parts and weighting factors –

Level	Sublevel	Spare Parts	Scenario A Weighting	Scenario B Weighting
LEVEL 1	1a	Display assembly	30%	25%
	1b	Battery	30%	25%
LEVEL 2	2	Back cover	10%	9%
LEVEL 3	3	Front camera(s) assembly	5%	4%

	3	Back camera(s) assembly	5%	4%
	3	External charging port(s)	5%	4%
	3	Mechanical Button(s)	5%	4%
	3	Microphone(s)	5%	4%
	3	Speaker	5%	4%
LEVEL 4	4	Hinge assembly or Fold mechanism	N/A	17%

The table above is applied across different technologies of smartphones and tablets through a dynamic approach between the weighting of scenario A and scenario B.

In the case of a non-foldable device, the scenario A weights are applied. Whereas in the case of a foldable device, where hinge assembly or fold mechanism are present, the sum of the priority part weightings would exceed 100% and be equal to 120%, therefore an adjustment with a correction factor ($f_c = 1/120$ %) is introduced in the scenario B in order to maintain the same balance of importance between parts.

Selection and weighting of Parameters

The parameters relevant to rate reparability for smartphones and tablets have been identified. As in the case of priority parts, these parameters can also have different levels of relevance as reflected in the different weighting factors assigned.

The parameters were selected having in regard the following principles:

- The complementary nature of the reparability scoring index to potential minimum requirements related to repair stipulated in the ecodesign draft regulation developed in parallel, including a balance between design-related and service-related aspects of reparability;
- The methodological consistency with the JRC general method developed in 2019, as well as the methodological foundations laid by the European standardisation work and the development of EN45554:2020;
- The applicability and verifiability of those parameters at EU level and within the ecodesign framework context;

- The result of a consensus-building exercise with the participation and contribution of a wide range of stakeholders via the organisation of stakeholder meetings and consultation processes.

Table 19: Selected parameters and weighting factors

Parameter	Weight	Justification
Disassembly Depth	25%	Key parameter for ease of repair and upgrade, not addressed by a minimum requirement.
Fasteners (type)	15%	Key parameter for ease of repair and upgrade, partially addressed by a minimum ecodesign requirement.
Tools (type)	15%	Key parameter for ease of repair and upgrade, partially addressed by a minimum ecodesign requirement.
Spare Parts (target group)	15%	Key parameter for ease of repair and upgrade, partially addressed by a minimum ecodesign requirement.
Software Updates (duration)	15%	Key parameter for ease of repair and upgrade, partially addressed by a minimum ecodesign requirement.
Repair Information	15%	Key parameter for ease of repair and upgrade, partially addressed by a minimum ecodesign requirement.

Finally, the selections and weightings above result in an overall final score. This can be calculated using the formula described in Table below. For parameters related to disassembly depth, fastener type and tools type, partial scores are first calculated at priority part level and then aggregated at parameter level using the weighting factors of priority parts. Finally, the parameter scores are aggregated in the overall score, based on the different parameter weighting factors.

Table 20: Calculation of the Overall Reparability Index

Parameter	**Score for priority part i [1-5]**	**Weight for priority part i [%]**	**Parameter Score [1-5]**	**Parameter Weight [%]**	**Final Score [1-5]**
#1 Disassembly depth	$S_{1,i}$	$\omega_{1,i}$	S_1 =	W_1	**Overall Reparability Index**

#2 Fasteners (type)	$S_{2,i}$	$\omega_{2,i}$	S_2 =	W_2	**R =**
#3 Tools (type)	$S_{3,i}$	$\omega_{3,i}$	S_3 =	W_3	
#4 Spare parts (target group)	…	…	S_4	W_4	
#5 Software updates (duration)	…	…	S_5	W_5	
#6 Repair Information	…	…	S_6	W_6	

Where:
R is the overall reparability score
S is the score (per spare part or parameter)
ω is the priority part weight
W is the parameter weight
i is a specific priority part,
N is the N of priority parts
J is a specific parameter

Each parameter will score between 1 and 5, reflecting (from low to high) the performance of the device in each of the reparability aspects covered by the scoring system.

Reparability scoring classification system

The methodology for a reparability scoring system proposes a classification system which would allow an understandable way of communicating reparability information to various audiences, including consumers. In order to propose such a system, a calibration exercise was conducted in parallel as part of the JRC study, in which a number of smartphone and tablet models were assessed. The reparability scores observed ranged between 1.16 and 4.27. This allows for the determination of a classification system which on one hand reflects current levels of reparability on the market, and at the same time ensures its future-proofness.

The classification system is presented in the table below.

Classification system for the representation of reparability scores

Reparability Score Class	Reparability Score Range
A	$x \geq 4.00$
B	$4.00 > x \geq 3.35$

C	3.35 > x ≥ 2.55
D	2.55 > x ≥ 1.75
E	1.75 > x ≥ 1.00

Assessment and verification

The assessment presented above would be verified on the basis of self-declaration whereby the Original Equipment Manufacturers (OEMs) provide to Member State Authorities (MSAs) on request:

- the analytical calculation of the final score per parameter;
- a disassembly map and disassembly protocol that describe all the disassembly steps considered necessary to replace each of the priority parts (as defined in the Scoring System Report), including an indication of the tools needed and the types of fasteners to be removed;
- the list of parts available for professional repairer and/or consumer as well as a detailed description of the information provided for professional repairer and/or consumer.

How to implement the reparability score at policy level, is described under Annex 9.

Annex 9: Policy Options and Measures

Introduction: scope of the initiatives

As usually done in Ecodesign preparatory studies, the identification of the products (sub)groups to be covered by the regulatory initiatives (Ecodesign, Energy Labelling) started from the denominations of the product group(s) indicated in the reference policy documents, in this specific case the 'Circular Economy Action Plan 2020' (CEAP 2020), that referred to requirements for 'mobile phones, tablets and laptops'.

Concerning mobile phones and tablets, the preparatory study then elicited the scope of the initiative as referred to four product subcategories, i.e. smartphones, tablets, cordless[24] phones and 'mobile phones other than smartphones' (also known as feature phones). This was done while implementing the 'task 1' of the reference methodology for Ecodesign, the MEErP (Methodology for ecodesign of energy-related products); in fact task 1 foresees, among others, the identification of the preliminary product scope and of the relevant definition(s).

Concerning laptops, they are in scope to the already existing Ecodesign Regulation 617/2013 on computers. Furthermore, laptops have a far stricter relation with desktops computers (rather than with mobile phones and tablets): the microprocessor architecture, the operating system and the application software is closer, when not identical. The Ecodesign Regulation 617/2013 was already under review[25] at the moment of the publication of the CEAP 2020. It was therefore decided quite straightforwardly to 'inject' the analysis of the feasibility of circular economy requirements into the already ongoing review. To date, this review is still ongoing, and, in procedural terms, it is behind the initiative on Ecodesign/Energy labelling of smartphones and tablets. Material efficiency requirements similar to those identified for smartphones and tablets are being analysed also in this review.

The review of Regulation 617/2013 together with the (new) Ecodesign Regulation on smartphones and tablets will respond to the CEAP 2020 commitments.

It was decided not to include mobile phones and tablets in the Ecodesign Regulation on computers under review (and to rather go for dedicated regulatory initiatives, analysed in the current impact assessment) for the following reasons:

- Because of the intrinsic differences between mobile phones and computers (whether they are laptop or desktop), in terms of product architecture, usage and behavioural patterns (see the clarification about tablets in the reminder of this section);
- the fact that, in terms of timing, the Ecodesign Regulation on computers will be finalised 1 or 2 years later than the one on mobile phones/tablets. Postponing the Ecodesign and Energy Labelling requirements on mobile phones/tablets in the short to medium term would leave mean to forego significant environmental benefits;
- the political momentum around the potential measures on smartphones.

[24] As highlighted in the preparatory study, cordless phones differ from mobile phones (as they only are "mobile" when used, whereas they sit most of the time in the charging cradle). Yet, they share a number of similarities with feature phones and there is potential for improvement at minimal cost. Moreover, stakeholders were not questioning their inclusion in the scope but were rather in favour.

[25] https://computerregulationreview.eu/welcome.html

In terms of product categories, the remit/scope of the Ecodesign Regulation 617/2013 on computers 'vis a vis' the (potential) Ecodesign Regulation on mobile phones and tablets is clarified in table below.

Ecodesign Regulation	**Product categories covered**
Ecodesign Regulation 617/2013	(a) desktop computers; (b) integrated desktop computers; (c) notebook computers, including tablet computers; (d) desktop thin clients; (e) workstations; (f) mobile workstations; (g) small-scale servers.
(potential) Ecodesign Regulation on mobile phones and tablets	(a) smartphones; (b) slate tablets; (c) cordless phones; (d) mobile phones other than smartphones.

Thanks to the above table, a clear 'demarcation line' can be established between the two Regulations on terms of scope/coverage. A specific product category, i.e. the one of tablets, deserves some additional explanations, given that 'tablet computers' (also known as 'notebook tablets') are in scope to the already existing Ecodesign Regulation 617/2013, whereas 'slate tablets' are in scope to the (potential) Ecodesign Regulation on mobile phones and tablets.

In general terms, tablets - except for notebook tablets - are a product group far closer to smartphones, with whom they generally share the electronic circuitry, operating system and the apps installed, than to computers. As such, in conceptual terms they are to be covered by the (potential) Ecodesign Regulation on mobile phones and tablets, under the definition of 'slate tablets' (see below).

As per the definitions of the Ecodesign Regulation 617/2013, a tablet computer is 'a product which is a type of notebook computer that includes both an attached touch-sensitive display and an attached physical keyboard'. The main distinguishing feature of this specific category of tablets (quite a niche one, in the current market) is the presence of the attached physical keyboard to the product.

In order:

- to avoid overlaps with this definition, and consequently a 'clash' of scope between two different Regulations

- at the same time, to minimise the 'grey areas' (i.e. specific product subcategories that would be covered neither by the Ecodesign Regulation 617/2013 nor the Ecodesign Regulation on mobile phones and tablets)
- to keep the rationale expressed above, i.e.
    - to have the 'bulk' of tablets on the market covered by the Regulation having in scope the products with more commonalities in terms of product architecture, usage and behavioural patterns, i.e. the (potential) Regulation on smartphones
    - to keep in scope to the Ecodesign Regulation 617/2013 only the specific subcategory of 'tablet computers'

the following definition of 'slate tablets' has been formulated.

'Slate tablet' means a device that that meets all of the following criteria:

(1) has an integrated display with a viewable diagonal size greater than or equal to 7.0 inches and less than 17.4 inches;

(2) does not have an integrated, physically attached keyboard in its designed configuration;

(3) primarily relies on a wireless network connection;

(4) is powered by an internal battery and cannot work without it

(5) is designed and placed on the market with an operating system (OS) designed to be used/analogous to operating systems used also in smartphones.

With this approach, neither risks of overlaps, nor of 'grey areas' between the two Regulations (Ecodesign Regulation 617/2013 and the (potential) Ecodesign Regulation on mobile phones and tablets) are expected.

The following examples show how tablets currently on the market would fall in scope either of the Ecodesign Regulation 617/2013 or of the (potential) Ecodesign Regulation on mobile phones and tablets

Aligned with these definitions, relevant potential "border-case" products can be grouped as follows:

'Slate tablets':

iPad Pro (keyboard sold separately, OS: iPadOS, which can be considered "analogous to smartphone OS"),

Lenovo Tab P11 (shipped with a detachable keyboard, so no physically attached keyboard, OS: Android),

Lenovo Tab M10 (no keyboard, OS: Android),

Lenovo Yoga Tab 13 (no keyboard, OS: Android)

Wortmann TERRA PAD 1006 (no keyboard, OS: Android)

Amazon Fire HD 10 Plus (available with and without detachable keyboard, OS: Android)

'Tablet computers':

Microsoft Surface Pro 8 (detachable keyboard, OS: Windows),

Microsoft Surface Book 3 (detachable keyboard, OS: Windows),

Dell Latitude 7320 Detachable (detachable keyboard, OS: Windows),

Lenovo IdeaPad Flex 3 Chromebook (permanently attached keyboard; OS: Chrome OS),

Lenovo Yoga 7 (permanently attached keyboard; OS: Windows),

Acer Chromebook Convertible (permanently attached keyboard, OS: Chrome OS)

CSL Panther Tab (detachable keyboard, OS: Windows)

Hyrican ENWO Tab (detachable keyboard, OS: Windows).

The proposed 'repartition' of scope between the Ecodesign Regulation 617/2013 and the (potential) Ecodesign Regulation on mobile phones and tablets aims to minimise the chances of 'grey areas', though there could always be specific products that would be covered neither by the Ecodesign Regulation 617/2013 nor the Ecodesign Regulation on mobile phones and tablet. To date, there are only a few products on the market that, despite being 'notebook tablets' because of their operating systems not for use also in smartphones, have the keyboard not attached, but sold as an accessory, or no keyboard at all[26]. These products can be put in scope to the computer Ecodesign Regulation 617/2013, at the time of finalisation of its review.

Option 2: voluntary agreement/Eco Rating scheme

The option of a voluntary agreement was covered by the published impact assessment inception report as in early 2021 an environmental scoring system proposed by MNOs and supported by several manufacturers was under development and it could not be ruled out, that this industry initiative develops into a self-regulatory initiative, which could be considered a valid alternative to an Ecodesign regulation. As of early 2022 this scheme is in place, but fails to meeting basic criteria of a voluntary agreement. This option of a voluntary agreement therefore

[26] See the Lenovo ThinkPad X1 Fold and Microsoft Surface Go 3.

is discarded in the analysis, but the forecasted effect of the Eco Rating scheme on the market is considered as part of the baseline.

The status and specifics of the Eco Rating scheme are as follows explaining also why this initiative despite its merits does not qualify as a voluntary agreement:

Several telecom network operators and handset manufacturers established an Eco Rating system for mobile phones that was published in May 2021. It is based on ITU-T L.1015[27] and ITU L.Sup32[28] standards, and is aligned with several other current initiatives, such as the material efficiency standards under mandate M/543 (EN 45550 to EN 45559), different eco-label criteria, the Methodology for ecodesign of energy-related products (MEErP) and others. The rating was initiated several years ago, and several mobile network operators considered joining the rating system. The Eco Rating covers a range of scoring criteria on:

- Durability;
- Reparability, reusability and upgradability;
- Recyclability and recoverability;
- Use of hazardous and restricted substances;
- Use of recycled and renewable materials;
- Packaging and accessories.

And a screening life cycle assessment with parameterized activity data and generic background datasets. The screening life cycle assessment approach is aligned with the Product Environmental Footprint (PEF) methodology – with the caveat that there are no PEF category rules for this product group yet -, and largely relies on a parameterized assessment model, based on generic background data. The final assembly step is supposed to be modelled with primary data on energy consumption. Similarly, transports and distribution are meant to be modelled with actual means of transportation.

Eco Rating criteria cover aspects beyond the scope of Ecodesign requirements, such as content of potentially hazardous substances. Some of these substances are restricted by the European RoHS Directive 2011/65/EU, but others are not. Another criterion is the warranty period, which is also outside the scope of potential Ecodesign requirements.

The Eco Rating does not cover cordless phones and tablets. Furthermore, it does not meet the requirements of a formal self-regulatory initiative as an alternative to an ecodesign Regulation, since it is led by telecom providers and not by manufacturers. Moreover, its total market coverage is currently around 25%. For a Voluntary Agreement to be considered as an

[27] 'Criteria for evaluation of the environmental impact of mobile phones'
[28] 'Supplement for eco-specifications and rating criteria for mobile phones Eco Rating programmes'

alternative, the market share should be at least 80% according to the Commission's guidelines for self-regulation measures (C/2016/7770). The Eco Rating also does not include specific threshold requirements, nor overall quantified improvement targets to be achieved. As such, the market response depends entirely on the provision of information and the approach does not allow for stringent target setting procedures for conformity assessment (European Commission 2021). Eco Rating was rolled out in 2021 and scores are communicated by individual network operators in several EU member states. There is the potential of a future evolution of the rating system, e.g. the possibility that other operators as well as other stakeholders in the industry (manufacturers, retailers, NGOs, public institutions, etc.) could also have access to this methodology, but this is highly uncertain as the Eco Rating scores are used sparely in marketing by MNOs and did not (yet) lead to a de-listing of brands, which do not report Eco Rating scores. Without further evolution this Option is considered to have a "one time effect", but it should be acknowledged that the Eco Rating is meant to be revised and updated regularly. This would lead to a constant evolution of the market towards reduced environmental impacts throughout the life cycle of the products. Under optimal conditions, i.e. outstanding visibility of the score at the point-of-sales and in MNOs online shops, including convenient options for comparing devices, half of the 25% market share (12.5 %) are forecasted choose a device with a significantly better scoring. Given the current shortcomings of the implementation as of 2022, i.e. no full coverage of the product portfolio of MNOs as Apple devices are not scored, and display of scores typically as one of many specification characteristics, it is rather likely that only 5% of the overall EU smartphone market is steered towards more environmentally-friendly devices. This 5% penetration rate is considered in the calculation of the baseline.

Option 3.1: Ecodesign requirements for smartphones and tablets & Options 3.2a and 3.2b: Ecodesign requirements regulating also mobile phones other than smartphones and cordless phones

Option 3.1 follows the ecodesign requirements set out in Annex II of the working document on the potential Ecodesign Regulation (this working document was presented and discussed at a meeting of the Ecodesign Consultation Forum convened on 28 June 2021), but without regulating the mobile phones other than smartphones (i.e., feature phones) and cordless phones due to the lower improvement potential for these two sub-segments. Option 3.2 extends the Ecodesign requirements presented under Option 3.1 also to mobile phones other than smartphones (so-called feature phones) and cordless phones. Option 3.2 covers two level of ambition: Option 3.2a with specific reparability and durability requirements plus energy efficiency information requirements and Option 3.2b with additional information requirements on material content, recyclability and selected upstream greenhouse gas emissions. As the preparatory study identified a relevant potential for reducing environmental impacts and Life Cycle Costs for a range of requirements, priority is given to measures addressing:

- Reparability and reusability, including facilitating repair by consumers, but not adversely affecting the durability of devices and in particular:
    - Availability of spare parts;
    - Access to repair and maintenance information;

    - Maximum delivery time of spare parts;
    - Maximum price of spare parts;
    - Disassembly requirements;
    - Requirements for preparation for reuse.
- Reliability and in particular:
    - Resistance to accidental drops;
    - Scratch resistance;
    - Protection from dust and water;
    - Battery endurance in cycles;
    - Battery management and fast charging;
    - Software updates and operating system support.
- Marking of plastic components;
- Further information requirements (Options 3.1 and 3.2b only):
    - Recyclability requirements
    - Material content information
    - Upstream greenhouse gas emissions

Several additional potential requirements have been analysed in the preparatory study and finally have been discarded from the proposed Ecodesign requirements. These are listed in Table 21 with a justification, why these requirements have been discarded.

Table 21: Analysed but discarded ecodesign requirements

Potential requirement	Main reasons for discarding this requirement
Reparability requirements regarding board-level repairs (desoldering and resoldering of semiconductor components)	Low relevancy for out of warranty repairs (<<1% of repair cases), major technological and cost challenges for third parties
Reparability requirements: Mainboards as spare parts for third parties	Low relevancy for out of warranty repairs, low environmental benefit as the mainboard components are those with the highest environmental impacts, high repair costs due to high component costs
Reparability requirements: Spare parts beyond displays and batteries available for consumers	Requirement would for consistency also require a product design which allows for repairs by non-professionals, thus requiring major design changes to enable repair of less often failing parts
Reparability requirement: Battery replaceable without tools	Although there are precedents for such designs, this is seen as having a major impact on current device designs and limits design options significantly
Reparability requirements: Separable tablet digitizer unit and display module to ease separate replacement of cover glass / digitizer unit	Major performance issues (user experience, display brightness, energy consumption, overall drop resistance)
No fast charging by default	Evidence on battery ageing due to fast charging is outdated with current battery technology, aspect sufficiently covered by

Potential requirement	Main reasons for discarding this requirement
	the battery endurance requirement (to be tested with fast charging, if supported by the device)
Disclosure of Life Cycle Assessment / Product Environmental Footprint data	Lack of Product Category Rules for a standardised assessment approach
Incentivising protective cover use by allowing durability tests to be performed with protective cover, if shipped with the product	Risk of unintended side effects: Additional production impacts from protective covers, which in the end might not be used or being replaced by the user
Specific minimum requirements on drop resistance for tablets	No statistical evidence to define appropriate minimum requirements, statistics indicate lower relevancy of incidental drops compared to smartphones
Specific minimum requirement on ingress protection against water damage due to immersion (IPx7) for smartphones and tablets	Design conflict with reparability and recyclability
Minimum recyclability requirements	Too small difference in the market for an effective specific requirement, no product specific standard to assess recyclability yet
Extended list of declarable critical raw materials	Conflict with product performance (not incentivizing reduction of e.g. Gallium in products to avoid RF interface performance constraints)
Information requirement on bio-based plastics content	Negligible environmental benefit

The ecodesign measures for Option 3.1 and Options 3.2a and 3.2b are detailed in the paragraphs below. For the full information on the legal formulation, please refer to Annex II of the working document[29]. Requirements are supposed to apply from 2023 onwards. The nature and rationale, market readiness level, as well as the expected impacts on durability, reparability and energy efficiency of products are also described under Annex 4.

Statistical evidence, environmental impacts and stated cost figures below[30] have been researched and calculated in the course of the preparatory study and were subject to the related stakeholder process, which did not yield any questioning of stated cost data.

Reparability and reusability

The analysis in the Ecodesign preparatory study indicated a positive impact of enhanced reparability and reusability. The main environmental and cost benefits are achieved, if product

[29] https://circabc.europa.eu/ui/group/418195ae-4919-45fa-a959-3b695c9aab28/library/27d6da9b-e309-4627-a902-d05ff287f159?p=1&n=10&sort=modified_DESC

[30] These cost figures refer to individual products or components, but it should be kept in mind, that by far not all costs materialise for all products (i.e., not all products need to be repaired), which means the market wide costs effect is typically much lower in such cases. See the economic impacts analysis for market wide totals.

lifetime is extended through better reparability and reusability. Most important – as identified in the preparatory study - are enabling repairs through better spare parts availability, repair-friendly design (related to the tools needed and fastening technologies employed), information to localise defects and on the correct repair processes, and reduced repair costs (due to simpler, less demanding repair processes). Facilitating repair by professional repairers is similarly important as better reparability by end-users. However, repair by consumers can involve safety issues, if the design of some devices is not significantly changed. Devices with slim form factors that make batteries and displays easily replaceable for laymen and with commonly available tools and featuring high ingress protection (IP) classes are not yet widely available. Specific requirements that can improve reparability and reusability are in particular the availability of spare parts, access to repair and maintenance information, maximum delivery time of spare parts, maximum price of spare parts, disassembly requirements and requirements for preparation for reuse.

It should be noted, that defects are a major limiting factor for product lifetime, but the barriers to repair are manifold (design, spare part and tool availability, costs, information gaps, etc.). For this reason only an interrelated set of requirements addressing these barriers simultaneously will unfold the full potential. Measures reflect the findings on defects, repairs and reasons for discontinuing device use presented in Annex 5.

The details for the specific requirements for Option 3.1 and Options 3.2a and 3.2b are presented below.

Availability of spare parts

Manufacturers, importers or authorised representatives shall make available to professional repairers at least the following spare parts (when present), including required fasteners, if not reusable. Those spare parts that shall also be made available to end-users are indicated by "(u)":

Table 22: Spare parts availability for Option 3.1 and Options 3.2a/3.2b (availability to end-users indicated by (u))

Smartphones (incl. in Option 3.1 & Options 3.2a /3.2b)	Tablets (incl. in Option 3.1 & Options 3.2a/3.2b)	Feature phones (incl. in Options 3.2a/3.2b)	Cordless phones (incl. in Options 3.2a/3.2b)
Battery (u)[31]	Battery (u)[32]	Battery (u)[153]	Battery (u), battery compartment cover (u)
Display assembly (u)	Display assembly (u)	Display unit (u)	Display unit

[31] Alternatively the manufacturer shall ensure that the battery endurance in cycles achieves a minimum of 1000 full charge cycles, and after 1000 full charge cycles the battery must, in addition, have in a fully charged state, a remaining capacity of at least 80 percent of the rated capacity and the device is at least dust tight and protected against immersion in water up to 1 meter depth.

[32] Alternatively the manufacturer shall ensure that the battery endurance in cycles achieves a minimum of 1000 full charge cycles, and after 1000 full charge cycles the battery must, in addition, have in a fully charged state, a remaining capacity of at least 80 percent of the rated capacity.

Smartphones (incl. in Option 3.1 & Options 3.2a /3.2b)	Tablets (incl. in Option 3.1 & Options 3.2a/3.2b)	Feature phones (incl. in Options 3.2a/3.2b)	Cordless phones (incl. in Options 3.2a/3.2b)
Charger (u)	Charger (u)	Charger (u)	Charger (u)
Back cover or back cover assembly	Back cover or back cover assembly	Back cover or back cover assembly	Back cover
Front-facing camera assembly	Front-facing camera assembly	Front-facing camera assembly	
Rear-facing camera assembly	Rear-facing camera assembly	Rear-facing camera assembly	
External connectors	External connectors	External connectors	External connectors
Buttons	Buttons	Buttons	Buttons
Microphone	Microphone	Microphone	Microphone
Speaker(s)	Speaker(s)	Speaker	Speaker
SIM tray and memory card tray	SIM tray and memory card tray	SIM tray and memory card tray	
Hinge assembly	Hinge assembly	Hinge assembly	
Mechanical display folding mechanism;	Mechanical display folding mechanism;	Mechanical display folding mechanism;	
Mechanical display rolling mechanism	Mechanical display rolling mechanism	Mechanical display rolling mechanism	

Relevancy of the target parts is confirmed by repair statistics and consumer surveys as follows: Displays and batteries, but also backcovers, are confirmed to be those parts, which fail or break most often (approx. 75-90% of defects). Much less frequently defects affect the other listed parts (10-25%). Access figures to third-party repair instructions demonstrate that replacement of these other parts is also relevant. There is little information yet about failures of folding or display rolling mechanisms, but typically any mechanical moving part is subject to relevant failure rates.

The preparatory study established that the lack of spare parts prevented 4% of the respondents in a study on consumer repair attitudes to repair their smartphones (van den Berge and Thysen 2020). This is apparently the share of repair cases, which can be addressed with better spare parts availability.

Access to repair and maintenance information

The manufacturer, importer or authorised representative shall provide access to the repair and maintenance information to professional repairers (smartphones and tablets only in option 3.1, all devices in options 3.2a, 3.2b):

- the unequivocal appliance identification;
- a disassembly map or exploded view;
- wiring and connection diagrams, as required for failure analysis;
- electronic board diagrams, as required to the level of detail needed to replace listed parts;
- list of necessary repair and test equipment;
- technical manual of instructions for repair;
- diagnostic fault and error information (including manufacturer-specific codes, where applicable);
- component and diagnosis information (such as minimum and maximum theoretical values for measurements), except for personal identifiable information, unless if relevant for a repair operation;
- instructions for software and firmware (including reset software);
- information on how to access data records of reported failure incidents stored on the device (where applicable and except for personal identifiable information such as related to user behavior, location information);
- the procedure for user authorisation of parts replacement when required for a repair, and software tools, firmware and similar auxiliary means required for full functionality of the spare part and device after repair, such as remote or onsite authorisation of serial numbers.

This information requirement complements the spare parts availability requirement above as for a successful repair appropriate information and guidance is essential. Although there is some documentation provision effort on the manufacturers side, such kind of information is considered to be largely existing already for in-house repair and no significant additional costs are expected for compiling this information.

Maximum delivery time of spare parts

Importers or authorised representatives shall ensure the delivery of the spare parts within 5 working days after having received the order (smartphones and tablets only in option 3.1, all devices in options 3.2a, 3.2b).

Delivery time of spare parts is a critical factor for repairs, as users of mobile devices typically depend on the proper functioning of the devices. 5 days seems to be a compromise between this need to get the repair done and the logistics effort on the manufacturers' side to guarantee these delivery times across the EU market. It is assumed, that spare parts will be already on stock within the EU when being ordered for a repair and that these spare parts are not produced

"on demand" outside the EU. This requires a proper forecast of spare parts needs by the manufacturer, and potentially putting on stock larger amounts of spare parts once these parts are subject to a pre-announced component discontinuation ("last time buy").

Maximum price of spare parts

Manufacturers, importers or authorised representatives shall indicate a maximum pre-tax price for spare parts (smartphones and tablets only in option 3.1, all devices in options 3.2a, 3.2b).

The main effect of this requirement will be an informed choice by consumers for products where repair is less costly and to avoid that manufacturers charge excessive spare parts costs to undermine the spare parts availability requirement.

This requirement results in better transparency in the market and is likely to reduce repair costs for consumers. The costs for manufacturers are not likely to increase due to this requirement, but the margin for costly repairs might be lower then.

Use of standardised parts and components

As the vast majority of cordless phones is powered by standard AA or AAA size batteries it is considered important to keep this level of repair-friendliness. Compatible AA and AAA batteries are widely available at low costs, resulting in a very low barrier for replacing weak batteries. As there is a market trends towards non-standardised integrated batteries in cordless phones (market share <15%) it is considered important not to leave this aspect unregulated. The requirement in Options 3.2a and 3.2b is as follows:

- cordless phones shall be designed for the use of rechargeable batteries with standardised physical dimensions

Given that there are no such standardised battery sizes for smartphones, feature phones and tablets, no such requirement is formulated. Such a requirement would require a standardisation of these batteries first and consequently such a measure could be considered for a later review of the regulation only.

Disassembly requirements

Manufacturers, importers or authorised representatives shall ensure that the process for battery replacement meets the following criteria, following definitions set out in EN 45554:2020:

Table 23: Disassembly requirements for batteries for Option 3.1 and Options 3.2a/3.2b

Criterion	Smartphones (incl. in Option 3.1 & Options 3.2a/3.2b)	Tablets (incl. in Option 3.1 & Options 3.2a/3.2b)	Feature phones (incl. in Options 3.2a/3.2b)	Cordless phones (incl. in Options 3.2a/3.2b)

Fasteners and connectors	Reusable	Reusable	Reusable	Reusable
Tools	Feasible with: — the use of no tool, or — a tool or set of tools that is supplied with the product or spare part, or —basic tools as listed in Annex A.4 of EN 45554:2020.	Feasible with: — the use of no tool, or — a tool or set of tools that is supplied with the product or spare part, or —basic tools as listed in Annex A.4 of EN 45554:2020.	Feasible with: — the use of no tool, or — a tool or set of tools that is supplied with the product or spare part, or —basic tools as listed in Annex A.4 of EN 45554:2020.	Feasible with: — the use of no tool, or — a tool or set of tools that is supplied with the product or spare part, or —basic tools as listed in Annex A.4 of EN 45554:2020.
Working environment	Use environment	Use environment	Use environment	Use environment
Skill level	Layman	Layman	Layman	Layman
Exemptions	Battery demonstrated to last 500 cycles @ 83%[33], 1000 cycles @ 80% and at least dust tight and protected against immersion in water up to 1 meter depth.	Battery demonstrated to last 500 cycles @ 83%[155], 1000 cycles @ 80%	Battery demonstrated to last 500 cycles @ 83%[155], 1000 cycles @ 80% and at least dust tight and protected against immersion in water up to 1 meter depth.	

Manufacturers, importers or authorised representatives shall ensure that the process for display replacement meets the following criteria, following definitions set out in EN 45554:2020.

[33] Interim checkpoint in the cycle test introduced to potentually shorten the test duration

Table 24: Disassembly requirements for displays for Option 3.1 and Options 3.2a/3.2b

Criterion	Smartphones (incl. in Option 3.1 & Options 3.2a/3.2b)	Tablets (incl. in Option 3.1 & Options 3.2a/3.2b)	Feature phones (incl. in Options 3.2a/3.2b)	Cordless phones (incl. in Options 3.2a/3.2b)
Fasteners and connectors	Removable	Removable	Removable	Removable
Tools	Feasible with commercially available tools	Feasible with commercially available tools	Feasible with commercially available tools	Feasible with commercially available tools
Working environment	Workshop environment	Workshop environment	Workshop environment	Workshop environment
Skill level	Generalist	Generalist	Generalist	Generalist

Manufacturers, importers or authorised representatives shall ensure that the process for all other listed spare parts and batteries covered by the exemption for durable batteries meets the following criteria, following definitions set out in EN 45554:2020.

Table 25: Disassembly requirements for other listed spare parts for Option 3.1 and Options 3.2a/3.2b

Criterion	Smartphones (incl. in Option 3.1 & Options 3.2a/3.2b)	Tablets (incl. in Option 3.1 & Options 3.2a/3.2b)	Feature phones (incl. in Options 3.2a/3.2b)	Cordless phones (incl. in Options 3.2a/3.2b)
Fasteners and connectors	Removable	Removable	Removable	Removable
Tools	Feasible with commercially available tools	Feasible with commercially available tools	Feasible with commercially available tools	Feasible with commercially available tools
Working environment	Workshop environment	Workshop environment	Workshop environment	Workshop environment
Skill level	Expert	Expert	Expert	Expert

As the most frequently failing parts, displays and batteries, are required to be available also for consumers[34], the product design is required to allow for such do-it-yourself repairs, in terms of joining technology used, tools required, working environment and skill level. The requirement for displays however acknowledges, that replacing these parts requires some repair skills, if proper sealing of the display unit is meant to remain a design option. For all other parts, for which spare part availability is required, the design has also to ease repairs, but acknowledging the major design changes, which might be required, if these repairs are meant to be undertaken also by consumers, and respecting the fact that these other parts are much less frequently subject to defects, the skill level targets at professional repair staff ("expert"). This applies also to the backcover, although being among the parts being subject to a rather high defect rate, as the backcover typically also acts as a frame and base for several other components.

The current dominating design of embedding batteries in mobile devices as outlined in the problem definition (Annex 5) is a major barrier for battery replacement. Frequently thermal energy, solvent, and/or prying force has to be applied in order to remove the battery. This may also increase the risk of physical damage to the battery and other components during the removal process. Professional repair operators are assumed to have the skills, tools and knowledge to remove and replace batteries independently of the type of adhesive employed, but the use of strong adhesives may increase the time spent on the process and therefore the involved repair cost for the user. There are adhesive based solutions available on the market, which allow for user replaceable batteries. According to findings of the preparatory study close to 50% of the best-selling smartphones sold in Europe in 2019 had a type of pull tab adhesive solution in place[35]. These and other more convenient design options are meant to lower the barrier for successful battery repairs. Furthermore, such designs are expected to reduce battery repair cost by approx. 5 Euros (less time spent on repair, less risk of damages), if repairs are done by professional repair shops. In case repairs are actually done by the users themselves, purchase and shipping of the battery, potentially ordering of tools, remains as costs, which will be significantly lower than in the case of a professional repair service.

The display is the single most part to fail, mainly due to accidental drops. In current designs display assembly are typically not easy replaceable due to the use of – occasionally excessive – use of glue, designs where the risk of ripping flex cables in the process is high or where numerous other parts have to be removed first, before giving access to the display. In general there is a huge spread in the market regarding how easy a display can be replaced. Setting a minimum standard for displays to be replaceable by experienced users helps to remove a significant barrier for repairs, in particular as display replacements by manufacturers are partly offered at excessive costs.

As both, battery and display, represent only a minor share of the environmental footprint of the device (each 5-10% of the impact), it is always worthwhile from an environmental perspective to replace display or battery to extend the product life.

Requirements for preparation for reuse

[34] With the exemption of particularly durable batteries, which are less of a lifetime limiting factor for the overall device

[35] But access to the battery was still challenged by the fasterner and joining technologies sealing the device as such.

Confidence in data erasure and ease of data transfer is very important for the second life of devices. The preparatory study identified concerns regarding data privacy as a major barrier for reuse: Still working or reparable devices after "first life" are frequently just kept at home in hibernation instead of making the device available for a second use cycle. Reusing phones and tablets avoids the production of new devices, thus, of related environmental impacts, and can provide consumers with a low-cost option compared to a new phone or tablet.

The best approach to reliable data erasure is data encryption by default and a factory reset that deletes the encryption key[36]. However, it is also important that the user receives information about data erasure once the use of the device is discontinued. Information on the battery life are also key indicators that can support reuse of the devices. The following Table summarizes the requirements for preparation for reuse for the Options 3.1 and 3.2a/3.2b.

Table 26: Requirements for preparation for reuse for Option 3.1 and Options 3.2a/3.2b

<table>
<tr><th>Smartphones
(incl. in Option 3.1 & Options 3.2a/3.2b)</th><th>Tablets
(incl. in Option 3.1 & Options 3.2a/3.2b)</th><th>Feature phones
(incl. in Options 3.2a/3.2b)</th><th>Cordless phones
(incl. in Options 3.2a/3.2b)</th></tr>
<tr><td colspan="2">Manufacturers, importers or authorised representatives shall ensure, that devices:

(a) encrypt user data by default;

(b) include a software function, that resets the device to its factory settings and erases by default the encryption key;

(c) record the following data from the battery management system in the system settings or another location accessible for end-users:

• Date of manufacturing of the battery;
• Date of first use of the battery;
• Number of full charge/discharge cycles (reference: rated capacity);
• Estimated state of health (full charge capacity relative to the rated capacity in %).</td><td colspan="2">Manufacturers, importers or authorised representatives shall ensure, that devices include a software function, that resets the device to its factory settings and erases by default address book, text messages and call history;</td></tr>
</table>

Reliability

[36] In case the encryption is in place already at end of (first) life, factory reset is a matter of minutes, whereas a full data erasure process (with potentially parts of the storage not being deleted as intended) can take few hours to complete, which is considered a barrier.

A product, which features a low defect rate will be used longer than a less durable device. Any defect, even under improved reparability conditions, is a trigger point, which might lead to the decision to upgrade to a new device. Minimizing defect rates by design is thus a sound strategy to extend product lifetimes, but is sometimes seen to be in conflict with aesthetic features. Eco-design requirements can significantly foster a better durability, in particularly of the most critical components, displays and batteries.

Besides the reparability related aspects there are several more aspects related to durability and lifetime extension in general. These aspects are summarised as reliability aspects and cover the following measures: resistance to accidental drops, scratch resistance, protection from dust and water, battery endurance in cycles, battery management and fast charging and software updates and operating system support.

Resistance to accidental drops

Manufacturers of the products within the scope of the regulation shall ensure that the products pass a repeated drop test without loss of functionality. The repeated free fall test requirements are summarised in the following Table for Option 3.1 and Options 3.2a/3.2b:

Table 27: Repeated free fall test requirements for Option 3.1 and Options 3.2a/3.2b

Smartphones (incl. in Option 3.1 & Options 3.2a/3.2b)	Tablets (incl. in Option 3.1 & Options 3.2a/3.2b)	Feature phones (incl. in Options 3.2a/3.2b)	Cordless phones
100 falls	Information requirement only	100 falls	NA

The number of specified falls rather represents an extreme case, but as stated in the preparatory study, roughly 5% of users experience weekly accidental drops of their smartphone, which means roughly 100 drops in 2 years, this requirement is rather meant to cover also these 5% of users. Furthermore, drop conditions in real life might significantly deviate from standardised test conditions (fall height, acceleration, floor conditions, tumbling), thus a safety margin in test conditions seems appropriate. Finally, drop resistance is subject to statistical variation and the sample size is an important aspect for this criterion. Sample size is defined to be five units, with a pass rate of 60%.

This specific durability requirement significantly contributes to an extended lifetime of mobile phones as the most typical reason for defects is addressed. Tests confirmed, that most frequently in such drop tests the display is subject to defects (Dobs et al. 2020), being also the defect experienced with such devices in real life.

Test costs, except device costs for the statistically needed sample size of 5, are moderate, as the actual tests in a tumble barrel is completed within approx. 10 minutes. The functionality check takes another 15 to 30 minutes.

Additional costs for most durable cover glasses is in the range of 1-3 Euros per device, as stated in the preparatory study. As drop resistance is not only about the cover glass but also requires thorough overall design and integrated shock absorbing features, overall price increase to pass the specific requirement will be slightly higher. This is however compensated for the average user by the extended product lifetime and less need for replacement purchases, but also saves on avoided repair costs.

Scratch resistance

Screen scratches as such do not affect the functionality of devices, but are a trigger for device replacement for aesthetic reasons. Furthermore, the resale value of devices with visible signs of use and wear is significantly lower (roughly 20-30% lower), being a major barrier to equipment reuse. These considerations are less relevant for cordless phones, thus cordless phones are not covered by this requirement.

The scratch resistance requirements are summarised in the following Table for Option 3.1 and Options 3.2a/3.2b:

Table 28: Scratch resistance requirements for Option 3.1 and Options 3.2a/3.2b

Smartphones (incl. in Option 3.1 & Options 3.2a/3.2b)	Tablets (incl. in Option 3.1 & Options 3.2a/3.2b)	Feature phones (incl. in Options 3.2a/3.2b)	Cordless phones
The screen of the device should pass the hardness level 4 on the Mohs hardness scale.			NA

Break-resistant cover glasses are typically also scratch resistant. For most smartphones meant to meet the drop resistance requirement, scratch resistance does not mean additional costs.

Protection from dust and water

A distinction of protection levels against water and dust ingress as listed in Table 29 addresses major differences in protection levels: For dust protection levels up to IP4x are irrelevant due to specified particle sizes. Water protection up to IPx3 is considered to be of low effectiveness (dripping and spraying of water), but to ensure at least a minimum level of water ingress protection IP44 can be considered a specific requirement.

Table 29: IP codes scoring – relevant protection levels and specific requirement (in bold)

Dust ingress protection		Water ingress protection	
Level	Object size	Level	Description of the protection
IP_x		IPx_	

up to 3	(n.a.)	up to 3	
4	>1 mm	4	Splashing of water
5	Dust protected	5	Water jets
6	Dust tight	6	Powerful water jets
		7 and above	Immersion, up to 1 m depth

Requirements related to protection from dust and water are summarised in the following Table for Option 3.1 and Options 3.2a/3.2b. Due to the typical indoor use of cordless phones protection against water (e.g., rain) is less relevant for cordless phones and consequently no specific requirement is proposed for these.

Table 30: Protection from dust and water for Option 3.1 and Options 3.2a/3.2b

Smartphones (incl. in Option 3.1 & Options 3.2a/3.2b)	Tablets (incl. in Option 3.1 & Options 3.2a/3.2b)	Feature phones (incl. in Options 3.2a/3.2b)	Cordless phones
Devices should be protected against the ingress of solid foreign objects of size bigger than 1 mm and splashing of water (IP44).			NA

The trend towards better ingress protection in recent years (see Annex 5) resulted in a significant reduction of defects related to water and humidity ingress. As the reparability requirements should not lead to designs with less ingress protection a separate requirement on protection from dust and water is set, which guarantees at least a moderate level of protection from such defects.

Costs to achieve IP44 are very moderate, and actually a significant share of the market already today meets this requirement (minimum 50%, see Annex 5). Therefore, this requirement is not related to relevant additional product costs, and anyway pays off for the consumer due to less defects experienced.

Battery endurance in cycles and per cycle

Requirements related to battery endurance in cycles are summarised in the following Table for Option 3.1 and Options 3.2a/3.2b. Given that cordless phones are subject to other charging patterns (most of the time placed fully charged in the charging cradle) the cycle test with full charge / discharge cycles does not represent actual use patterns. As batteries for cordless phones are furthermore required to be of standard size, thus easily replaceable at low costs (approx. 7 Euros for one extra battery set), no battery endurance requirement is set for cordless phones.

Table 31: Battery endurance in cycles for Option 3.1 and Options 3.2a/3.2b

Smartphones	Tablets	Feature phones	Cordless phones

(incl. in Option 3.1 & Options 3.2a/3.2b)	(incl. in Option 3.1 & Options 3.2a/3.2b)	(incl. in Options 3.2a/3.2b)	
At least 500 cycles at 80 percent remaining charge capacity.	At least 500 cycles at 80 percent remaining charge capacity.	At least 500 cycles at 80 percent remaining charge capacity.	NA

Battery management

Battery management can positively influence the performance of batteries by avoiding conditions that can accelerate battery degradation, such as high charge levels for extended periods of time and continuous maintenance charge. For this reason, the battery management should implement features to limit times at high charge. Users shall have the option to deactivate such features, if needed for their use patterns. As the charging cycles is different for cordless phones and as the possible user interaction would be challenged by the limited possibilities of the user interface of cordless phones menus, such a requirement does not cover cordless phones. Requirements related to battery management are summarised in the following Table for Option 3.1 and Options 3.2a/3.2b:

Table 32: Battery management and fast charging requirements for Option 3.1 and Options 3.2a/3.2b

Smartphones (incl. in Option 3.1 & Options 3.2a/3.2b)	Tablets (incl. in Option 3.1 & Options 3.2a/3.2b)	Feature phones (incl. in Options 3.2a/3.2b)	Cordless phones
include an optional charging method selectable by the user which terminates the charging process automatically, when the battery is charged to 80% of its full capacity			NA
provide a power management feature which by default ensures that once the battery is fully charged there is no further charging power supplied to the battery unless the charge level drops below 95% of its maximum charge capacity; users might disable this feature.			

Costs to implement such features relate mainly to software programming and are considered minor. Hardware changes are not required in most cases.

Software updates and operating system support

Manufacturers of the products within the scope of the regulation shall provide the following updates/upgrades free of charge. Requirements are summarised in the following Table for Option 3.1 and Options 3.2a and 3.2b:

Table 33: Operating system update and upgrade requirements for Option 3.1 and Options 3.2a/3.2b

Smartphones (incl. in Option 3.1 & Options 3.2a/3.2b)	Tablets (incl. in Option 3.1 & Option 3.2a/3.2b)	Feature phones (incl. in Options 3.2a/3.2b)	Cordless phones
Availability of operating system security updates for at least 5 years and the availability of functionality updates for at least 3 years.			NA

Long and continued support of the OS with updates and upgrades removes one of the main barriers for extended use of smartphones and tablets (see Annex 5). According to the preparatory study almost 20% of users bought a new device as software or applications stopped working on their device. These 20% are at stake for a prolonged lifetime through extended OS support. However, it does not solve the problem that third party software developers might not provide software versions that are compatible with all maintained OS versions. Since OS support depends most of the time on third party support (e.g., by Google for Android, SoC providers), a very ambitious specific requirement might be in conflict with future third party technologies. However, in 2021 Google and Qualcomm announced a strategy for longer Android OS support (Qualcomm Technologies, Inc. 2021) for which reason a mandatory specific requirement of availability of security updates for at least 5 years and the availability of OS version upgrades for at least 3 years is feasible.

Assumption on additional costs per device is based on approximately 1000 different smartphone models being on the EU market, with on average 150.000 sold units, and updates being in the cost range of "several hundred thousand US dollars per model" (Clark 2016), i.e. 2 Euros per device per major functionality update. The forecasted resulting longer product lifetime yields for the consumer cost savings higher than these additional costs. It should be noted, that costs for such updates increase for older models as limitations of the embedded hardware needs to be mitigated by software adaptations, which increases development costs. OS update costs are therefore not linear.

Given that cordless phones are not known to be subject to software induced obsolescence due to the less complex operating systems, no requirement is set for cordless phones.

Marking of plastic components

WEEE consists of a very broad variety of polymers and marking larger/heavier plastic components can contribute to better separation. Under Option 3.2b for this reason and to be consistent with similar requirements for other types of products, plastic components heavier than 50 g shall be marked by specifying the type of polymer with the appropriate standard

symbols or abbreviated terms set between the punctuation marks '>' and '<' as specified in available standards. The marking shall be legible.

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

- the marking is not possible because of the shape or size;
- the marking would impact on the performance or functionality of the plastic component;
- and marking is technically not possible because of the moulding method.

For the following plastic components no marking is required:

- packaging, tape, labels and stretch wraps;
- wiring, cables and connectors, rubber parts and anywhere not enough appropriate surface area is available for the marking to be of a legible size;
- PCB assemblies, PMMA boards, optical components, electrostatic discharge components, electromagnetic interference components, speakers;
- transparent parts where the marking would obstruct the function of the part in question.

As these types of products rarely contain plastics parts heavier than 50g (potentially found in backcovers of tablets or the basestation or charging cradle for cordless phones), this measure is relevant for few products only. For consistency reasons with Ecodesign requirements for other product groups with typically a higher share of plastic parts above 50g this requirement is set here. The cost effect for manufacturers is considered negligible or even zero, as marking of plastic parts is already common practice.

Recyclability requirements

It is crucial that the end of life of electrical and electronic equipment is already considered during the design phase. For this reason manufacturers, importers or their authorised representatives shall ensure that joining, fastening or sealing techniques do not prevent the removal of the components indicated in point 1 of Annex VII of Directive 2012/19/EU on WEEE or in Article 11 of Directive 2006/66/EC of the European Parliament and of the Council on batteries and accumulators and waste batteries and accumulators, when present. Furthermore, the dismantling information needed to access crucial components such as batteries should be made available free of charge.

This requirement applies to Option 3.1 and Options 3.2a and 3.2b and complements the requirements set by the WEEE Directive.

Information requirements

Specific information can reduce information asymmetries and lead to better environmental performance. For this reason, manufacturers, importers or authorised representatives shall provide the following information (Option 3.1 for smartphones and tablets only, and Options 3.2a and 3.2b for smartphones, feature phones, tablets and cordless phones):

- Compatibility with removable memory cards, if any;

- Energy efficiency index (EEI);
- Ingress protection rating;
- Minimum battery endurance in cycles in number of cycles;
- Instructions for access to battery health information;
- Instructions for battery maintenance;
- Instructions for de-installation of operating system updates, and re-installation of the operating system version running on the device prior to an update;
- If the package does not include a charger the following information: "For environmental reasons this package does not include a charger. This device is compatible with USB-C chargers."

Additional information requirements under Option 3.1 (for smartphones and tablets only) and Option 3.2b (for smartphones, feature phones, tablets and cordless phones) comprise:

- Whether the semiconductor chips are produced in a factory with a high reduction rate for fluorinated greenhouse gas emissions;
- Whether the display is produced in a factory with a high reduction rate for fluorinated greenhouse gas emissions;
- Whether air cargo is involved in shipping the device from final assembly to the location where the product is put on the market in the European Union;
- List of up to ten components, where electricity consumption is based on 100% renewable energy in the manufacturing stage with the highest electricity consumption of this particular supply chain;
- Indicative weight range of selected critical raw materials and environmentally relevant materials[37] (tantalum, neodymium, gold);
- Recyclability rate $R_{cyc;}$
- Optionally, the percentage of recycled content for the product or a part thereof;

Justification and rationale for individual information requirements are provided in Table 34.

Table 34: Justification and rationale for information requirements

Information requirement	Rationale
Compatibility with removable memory cards, if any	• As memory components contribute significantly to the total environmental footprint of mobile devices (approx. 10-25% depending on specification), the user shall be motivated not to buy devices with highest memory spec, if memory can be extended as needed, and

[37] Despite its relevance, as it emerges from this impact assessment, cobalt is not included in this list, as this (i.e. information on the content in cobalt of the battery) is already foreseen Article 13 of the Battery Regulation.

Information requirement	Rationale
	to motivate the reuse of (removable) memory components • No additional costs
Energy efficiency index (EEI)	• Energy efficiency established on the basis of battery endurance per cycle is important to transparently allow for a consumer choice of energy efficient devices; incentivizing long run time per single battery charge can save up to 30% of use energy, and can contribute to a longer overall product life (slower battery ageing due to less frequent charging) • Create better visibility for devices with outstanding energy efficiency • Low test costs (maximum few days of lab testing per model)
Ingress protection rating	• Ingress protection is important for product durability as among non water ingress protected devices water damages represent a major cause for product defects (>20%), frequently to a non-repairable extend (short-cuts, corrosion); as such, a high IP rating contributes to lifetime extension • Create better visibility for devices which are unlikely to experience water damages • Low test costs (few minutes test time in a specific test chamber)
Minimum battery endurance in cycles in number of cycles	• Battery performance degradation is one of the major reasons to replace a mobile device; increased battery endurance can significantly contribute to an extended product lifetime (measure is among those with the highest environmental and consumer costs savings potential); market spread: Best performing devices in the range of 50% longer battery life compared to low performing devices • Create better visibility for devices with particularly long living batteries • But: relevant test costs in the range of few 1000 Euros per model due to long test times (several months)

Information requirement	Rationale
	• Slightly higher costs for high-quality batteries are overcompensated for consumers by the less frequent need for replacement purchases
Instructions for access to battery health information	• Battery state-of-health information is important for reuse as it helps to estimate whether reuse is worthwhile (confidence in used products) • As a secondary aspect, battery health data also helps to understand if short battery endurance on one charge is due to battery health or other factors (frequently: excessive power drain due to applications running in the background) • Data is typically already available from the battery management system, just needs to be displayed in a user-friendly manner • Negligible costs for manufacturers, potentially higher reuse sales value for consumer
Instructions for battery maintenance	• Charging patterns play a significant role for battery lifetime and degradation; well informed user behaviour can help to increase battery lifetime significantly • No costs for manufacturers, but potential significant savings for consumers due to less frequent replacement purchases
Instructions for de-installation of operating system updates, and re-installation of the operating system version running on the device prior to an update	• An OS upgrade might result in perceived or real performance losses, as e.g. hardware might not fully support the new OS version; such a user experience can lead to a premature replacement of the device, which can be mitigated, if at least the status before the upgrade can be re-established. • Significant costs for manufacturers to integrate roll back option • Uncertainty: Roll back to be supported also by third-party app providers
If the package does not include a charger the following information: “For environmental reasons this package does not	• Providing users with not needed chargers leads to avoidable production emissions (approx. 5% of total production related environmental

Information requirement	Rationale
include a charger. This device is compatible with USB-C chargers.”	footprint), less emissions from shipping (due to package sizes being reduced by approx. 40%) and reduced electronics waste (approx. -20% weight in the case of mobile phones); important information for users is with which chargers the device is actually compatible • Significant cost savings for manufacturers, relevant savings for consumers (2-5 Euros per device)
Whether the semiconductor chips are produced in a factory with a high reduction rate for fluorinated greenhouse gas emissions; Whether the display is produced in a factory with a high reduction rate for fluorinated greenhouse gas emissions; Whether air cargo is involved in shipping the device from final assembly to the location where the product is put on the market in the European Union; List of up to ten components, where electricity consumption is based on 100% renewable energy in the manufacturing stage with the highest electricity consumption of this particular supply chain	• Among the most relevant contributors to environmental life cycle impacts are greenhouse gas emissions for chip and display manufacturing (up to 10% are fluorinated greenhouse gases, which could be subject to abatement), use of renewable energy throughout the supply chain, and air cargo; hence, with few indicators a relevant share of emissions can be covered; transparency is required for informed consumer decisions and stimulates improvement actions by the manufacturers • Several large manufacturers are already used to quantifying relevant emissions for EPEAT[38] • Costs of implementing improvements are moderate (few Euro-cents per device), sea and ground transport however might result in delayed market introduction of new models • Saved societal costs (less environmental damage) overcompensate additional product costs
Indicative weight range of selected critical raw materials and environmentally relevant materials[159]	• Relevant elements comprise: Tantalum, neodymium, gold; similarly relevant critical raw materials have been discarded due to possible disadvantageous side effects (gallium: RF interface performance; indium: display performance; platinum group metals: reliability)

[38] Specific criterion under EPEAT for fluorinated greenhouse gas abatement rates, as specified in the IEEE 1680 series

Information requirement	Rationale
	• Information about material content can help to improve future targeted recycling processes to recover relevant critical raw materials (tantalum, neodymium) and materials with high environmental footprint (neodymium, gold); as there is little evidence on the current spread of these elements in mobile devices an information requirement provides transparency and potentially a data source to implement specific requirements in a future revision • Alignment with Ecodesign Regulation for other product groups • Analytical costs to establish or verify material content data is in the range of estimated 1000 – 3000 Euros per model
Recyclability rate R_{cyc}	• Current recyclability rates of mobile devices are particularly low (approx. 20%) as the focus is on some high-value target metals • Incentivizing high recyclability rates by design changes (best performing devices are at approx. 40%) helps to secure relevant raw materials for the EU industry • Creating transparency on recyclability in the market will lead to an evidence base for potentially specific minimum requirements in a future review of the requirements • Design changes result in increased product costs (potentially in the range of 1 – 5 Euros); low costs for calculating the recyclability rate as such • No cost benefit for consumers
Optionally, the percentage of recycled content for the product or a part thereof	• Using recycled content can reduce the environmental footprint of mobile devices by up to few percent • As manufacturers increasingly communicate about recycled content, it is important to create a sound basis for such claims; implementing a reference

Information requirement	Rationale
	to EN 45557:2020 for such claims establishes such common ground • Negligible costs for calculating the recycled content in compliance with EN 45557:2020 • But: Verification only possible through documentation checks, not through analytical means

Option 3.3: Ecodesign requirements with scoring index on reparability

This sub-option is based on Option 3.2b, complementing the minimum Ecodesign requirements with a reparability score for smartphones and tablets. Annex 8 describes in detail how the reparability score for smartphones and tablets developed by the JRC can be used for the calculation of reparability scores and classes. Combining specific ecodesign requirements with such a reparability score is a novelty for legislation and calculating the effects can therefore not be based on any prior experience with such a policy strategy. There are indications, that reparability is relevant to a certain extent as a purchase criterion for consumers and transparency regarding this aspect is likely to yield a pull effect on the market. Anecdotal evidence from the French market, where such a scoring system has been introduced in early 2021 also indicates that some manufacturers improve their service strategy to gain a better scoring. For the purpose of estimating the effects on the market it is assumed that repair rates increase over time with the introduction of a repair score, by a moderate 10 percentage points. The changes in the modelling are listed below.

Table 35: Assumed effects of a reparability score on repair rates

	Low-end smartphones	Mid-range smartphone	High-end smartphone	Tablet
Option 3.1&3.2: Specific and generic ecodesign requirements, but no reparability scoring				
repair rate battery (of broken devices)	70%	70%	70%	70%
display repair rate of broken devices)	60%	60%	60%	60%
other repair of broken devices	50%	45%	40%	45%
Option 3.3: Specific and generic ecodesign requirements, including reparability scoring				
repair rate battery (of broken devices)	80%	80%	80%	80%
display repair rate of broken devices)	70%	70%	70%	70%
other repair of broken devices	60%	55%	50%	55%

These changes result in approximately one month lifetime extension per device on average, based on the lifetime model introduced in the preparatory study. Under theoretical optimal

conditions of a 100% repair rate across all defects and product segments the average product lifetime would increase hypothetically by roughly 5 months, just to give an impression of the uncertainty range for this calculation.

Requirements, including the reparability score, are supposed to apply from 2023 onwards.

Concerning the consumer acceptance/understanding of a 'multi-dimensional' label (i.e. displaying energy efficiency together with parameters related to material efficiency), an analysis of the available evidence from recent studies in the field has been carried out. In particular, it appears clear that this information could be communicated via a product label. On this topic, a relevant study was finalised by the JRC in 2021[39]. The JRC conducted an online experiment with EU consumers on two categories of products: smartphones and microwaves ovens. The objective was to assess the relative effectiveness of three sustainability labelling approaches:

- positive labels - only identifying products with the best sustainability performance,
- negative labels - only identifying products with the worst sustainability performance, and
- graded labels - conveying the relative sustainability of all products.

Results suggest that graded labels are the most effective to steer consumer toward more sustainable purchase decisions.

Different formats of a (graded) label to depict reparability scores were tested in a consumer study conducted by CentERdata in the context of a framework contract with the European Commission. The results of this consumer study were published in 2020[40]. This study examined the most effective way of communicating reparability information to consumers through exploring the effects of different reparability information designs with the aim of incentivising repair rather than replacement behaviour. Based on qualitative focus group research in the Netherlands and Germany as well as input from (visual) communication experts, various icon and scale formats were developed and subsequently tested in a large-scale online experiment among nearly 10.000 consumers in seven EU Member States. In addition, the impact of the location of the information was examined, on the EU energy label versus not, and of the presence of the EU logo.

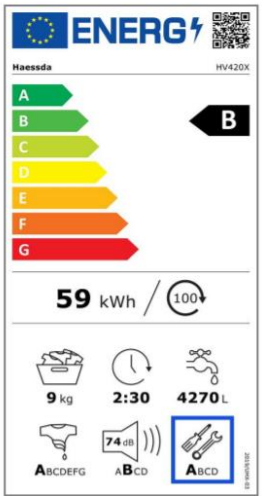
Among the labels tested was the icon with repair tools (Fig.A), also in the context of an energy label with multiple icons (Fig.B). Respondents were presented with three product sets: smartphones, TVs, and washing machines.

[39] Dessart, F.J., Marandola, G., Hille, S.L. and Thøgersen, J., Comparing the impact of positive, negative, and graded sustainability labels on purchase decisions, European Commission, 2021, JRC127006

[40] https://op.europa.eu/en/publication-detail/-/publication/46076b42-669a-11eb-aeb5-01aa75ed71a1

Fig.A: Reparability label tested

Fig.B: Reparability icon within a more complex energy label.



According to this consumer study, communicating product reparability information to consumers was effective in steering choices towards more reparable product alternatives in the online experiment. Out of the six product alternatives in each product set, the product with the best reparability class attracted 23% of the choices, on average, when reparability information was provided via a small label on the product information display. The exact same product attracted only 18% of the choices, on average, when reparability information was absent. Thus, the communication of reparability information in the experiment **resulted in an increase in the choice share for the product with the best reparability score relative to the baseline attractiveness of this product**. In the specific case of smartphone, in case of pre-information about the meaning of the icon, the preference for a product with best reparability features was almost double (from 15% to 29%). The results still suggest that these icon types benefit from an information campaign, which may be due to the similarity of icons used (in the case of the repair tools icon) or because exposure to the campaign makes it easier to grasp the meaning of the icon (which is more likely for the more complex repair process icon).

Option 4: Energy Labelling

This Option follows the obligations set out in the working document of the Commission Delegated Regulation supplementing Regulation (EU) 2017/1369 of the European Parliament and of the Council with regard to energy labelling of smartphones and tablets. This draft Regulation establishes requirements for the labelling of, and the provision of supplementary product information on, smartphones and tablets. The following information should be included in the label:

- QR code;
- Supplier's name or trade mark;
- Supplier's model identifier, meaning the code, usually alphanumeric, which distinguishes a specific mobile phone or tablet model from other models with the same trade mark or supplier's name;
- Scale of energy efficiency classes from A to G;
- The energy efficiency class determined in accordance with Annex II of the working document;
- Battery endurance per cycle in accordance with Annex III of the working document;
- Battery endurance in cycles in accordance with Annex IV of the working document;
- Ingress protection rating in accordance with Annex IV of the working document;
- Repeated free fall reliability class determined in accordance with Annex II of the working document.

The energy efficiency index (EEI) of a smartphone or tablet should be calculated using the following equation:

$$EEI = \frac{END_{Device}}{C_{rated}}$$

Where:

C_{rated} is the rated battery capacity in mAh

END_{device} would be an aggregated and normalised value in hours, calculated from cycle tests. These test cycles represent typical use patterns and cover:

Smartphone test scenario:

- phone call,
- web browsing over Wi-Fi,
- video streaming, data transfer (FTP download and upload),
- video playback,
- gaming,
- standby

Tablet test scenario:

- web browsing over Wi-Fi,
- video streaming, data transfer (FTP download and upload),
- video playback,
- gaming,
- standby

The determined EEI defines the energy efficiency class.

The energy efficiency classes provide transparency regarding the important feature of battery endurance per cycle, which is stated in consumer surveys as an important feature and purchase criterion, but which is not yet established on a comparable, harmonised basis. Corresponding to other Energy Labels implemented under Regulation (EU) 2017/1369, energy efficiency has to reflect the service delivered per energy input, therefore battery endurance per cycle is correlated with the battery capacity. The EEI approach is not only meant for transparency on efficient use of energy, but as a secondary effect also incentivizes an overall longer battery lifetime: The more efficiently the smartphone or tablet runs on a single battery charge the less frequent the battery has to be charged. As batteries degrade with every charging cycle, batteries with a high EEI require less frequent charging and thus enter a limiting state later. The incentive on manufacturers to have their products appear in the top classes of the energy label is expected to act as a strong driver, in particular in the light of the dramatic visibility of the EPREL public database[41].

As battery endurance per cycle as an absolute value is an important information for consumers to compare device performance, the absolute value is depicted separately on the label.

Three further criteria on the label refer to durability aspects of the devices:

- Battery endurance in cycles;
- Ingress protection rating;
- Repeated free fall reliability class.

These criteria have been chosen, as they represent to three most common reasons for defects or parts replacement: A degraded battery with low state-of-health, damages due to water ingress, and accidental drops most frequently resulting in broken displays. As such, these three criteria assemble aspects of a lifetime label, and create transparency in the market for informed consumer choices and to incentivize manufacturers to foster durability of devices by design.

[41] https://ec.europa.eu/info/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/energy-label-and-ecodesign/product-database_it#consultare-la-banca-dati

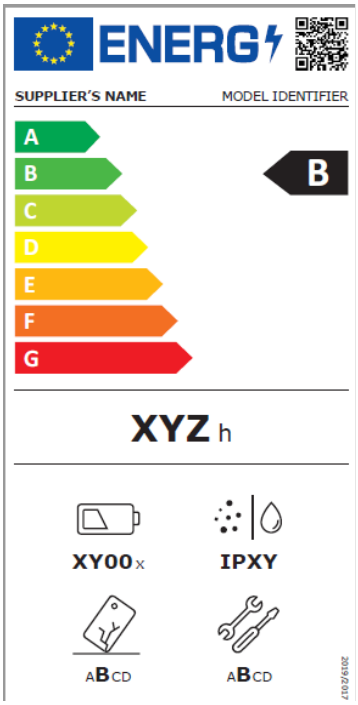
The Energy Label is supposed to be introduced in 2023.

Option 5.1: Ecodesign requirements combined with Energy Labelling.

Option 5.1 combines the ecodesign requirements (Option 3.2a) and energy labelling (Option 4) for smartphones and tablets. The battery endurance (per cycle) assessed with an Energy Efficiency Index (EEI) in Option 3.2a is more prominently translated to an additional Energy Label.

Option 5.2: Ecodesign requirements together with a scoring index on reparability plus Energy Label.

This Option combines the Ecodesign requirements with a scoring index on reparability (Option 3.3) and Energy Labelling requirements (Option 4). On the basis of the evidence from recent studies (see subsection 'Option 3.3: Ecodesign requirements with scoring index on reparability' under this Annex), the reparability score, as described under Annex 8, is depicted on the Energy Label, on top of those criteria listed under Option 4. As the Reparability score complements the specific reparability requirements of the Ecodesign regulation, only in this combined option the Reparability score is a reasonable component of the Energy Labelling requirements. The energy label for smartphones and tablets is shown in the figure below.



The proposed energy label gives relevant quantitative information both on the energy and the material efficiency aspects.

The energy aspect is – obviously – covered by the energy efficiency class.

Concerning the material efficiency aspects, the label would put under a positive light devices that are:

- durable, thanks to the information on
    - the battery long term performance (‘battery endurance in cycles’)
    - the water and dust protection rating (‘ingress protection rating’)
    - the impact resistance (‘repeated free fall reliability class’)
- and/or reparable (thanks to the reparability scoring).

This would imply that the ‘pull’ effect of the label (i.e. allowing more environmentally aware consumers to select products that have a superior environmental performance) would not only apply for energy efficiency, but also for material efficiency; this transparency reduces the information asymmetry present today. The energy label, by further “pulling” the market share of the best products, would complement the ecodesign measure that is “pushing out” the worst products from the EU market (‘push-pull’ effect).