DIGITALEUROPE

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Data points on supersedure of ecodesign regulation for smartphones and tablets over batteries regulation

Executive summary

The data points presented in this paper support the argument previously made by DIGITALEUROPE that the ecodesign regulation for smartphones and tablets offers a higher level of environmental protection compared to the batteries regulation.[1]

To support this argument, the data illustrate how the ecodesign regulation for smartphones and tablets offers a higher level of environmental protection compared to the batteries regulation. The data points illustrate that:

- Failure can be avoided when Ingress Protection is granted;
- Design choices increase physical durability and lead to a reduction of repair rate;
- Longer lasting batteries delay replacement of smartphones;
- Durability with professional repairability offers a high level of environmental protection.

1 Regulations 2023/1670 and 2023/1542, respectively.

DIGITALEUROPE
Rue de la Science, 37, B-1040 Brussels
T.+32 (0) 2 609 53 10 / www.digitaleurope.org / DIGITALEUROPE
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Introduction

The ecodesign regulation for smartphones and tablets offers a more comprehensive product sector specific approach and a higher level of environmental protection than the batteries regulation. The ecodesign regulation for smartphones and tablets promotes more durable smartphones and tablets for consumers, which will last longer before battery replacement is needed whilst ensuring consumers and professional repairers benefit from ease of repair that will encourage continued usage of product rather than seeking a new product. The ecodesign regulation for smartphones and tablets requires at least IP44 protection against water and dust, as well as battery endurance of 80% of rated capacity after 800 cycles – or IP67 protection and 80% of rated capacity after 1000 full charge cycles for professional replaceable battery designs. This focus of durability in addition to ease of repair is more onerous than the batteries regulation and entails the potential for less frequent battery replacement when compared to a product falling in the scope of the batteries regulation (Article 11(1)).

Between 2020 and 2023, approximately 587 million smartphones were shipped into Europe,[2] of which an estimated 165 million had IP67 protection or higher.[3]

[2] Based on data from Canalys Smartphone Analysis, https://canalys.com/newsroom/global-smartphone-market-2023

[3] Based on data aggregated from www.devicespecifications.com. For the analysis, 864 models launched by Samsung, Apple, Xiaomi, OPPO and Vivo in the 2020-2024 period were assessed by DIGITALEUROPE. In the absence of market shares by model, an approximation was used by weighing the data with market shares by brand, based on Statista data.

In other words, 422 million smartphones bought by European consumers in this period were not protected against water damage to the level that the ecodesign regulation for smartphones and tablets currently requires. If we assume a failure rate of 29 per cent,[4] of which 38 per cent related to water damage,[5] 46.5 million smartphones could have been prevented from becoming waste in Europe in just a three-year period if they had sufficient protection against liquid ingress. This amounts to approximately 3 million tons of CO2 that could be avoided by designing towards the ecodesign requirement (IP67).[6]

***46.5 million smartphones** in Europe could have been prevented from becoming waste in 2020-2023, equal to **3 million tons CO2** emission savings*

Achieving the ecodesign requirement of IP44 or above, which entail many environmental benefits, is possible by using an integral design with adhesives that provide seals against water ingress. Thermal energy, and by extension professional repair, is required to replace them properly and ensure the water sealing is correctly restored after repair. Smartphones with IP67 ratings or above represent an estimated annual European shipment of 40 million smartphones, which would be at risk of premature and typically catastrophic failure due to water damage if thermal energy cannot be used during the replacement process.

Designing according to the ecodesign requirements means achieving both a high level of liquid ingress protection and a demanding threshold for battery endurance, whilst enabling professional battery replacement. As we outline in the following pages, the first two conditions bring significant environmental benefits which exceed the environmental protection offered by the batteries regulation.

Focus on liquid ingress protection ensures a higher level of environmental protection

***75% reduction** of repair rate with introduction of IPx7*

The volume of repairs gets significantly reduced by addressing one of the most common failure points of smartphones, i.e. liquid ingress. In 2021, a Norwegian consumer survey reported 29 per cent of broken smartphones in two years.[7] The failure mode 'dropped into water' in 2018 was responsible for 38 per cent of accidental smartphone damages.[8] The ecodesign impact assessment for

[4] Laitala et al., 'Increasing repair of household appliances, mobile phones and clothing: experiences from consumers and the repair industry,' *Journal of Cleaner Production* 282, 2021.

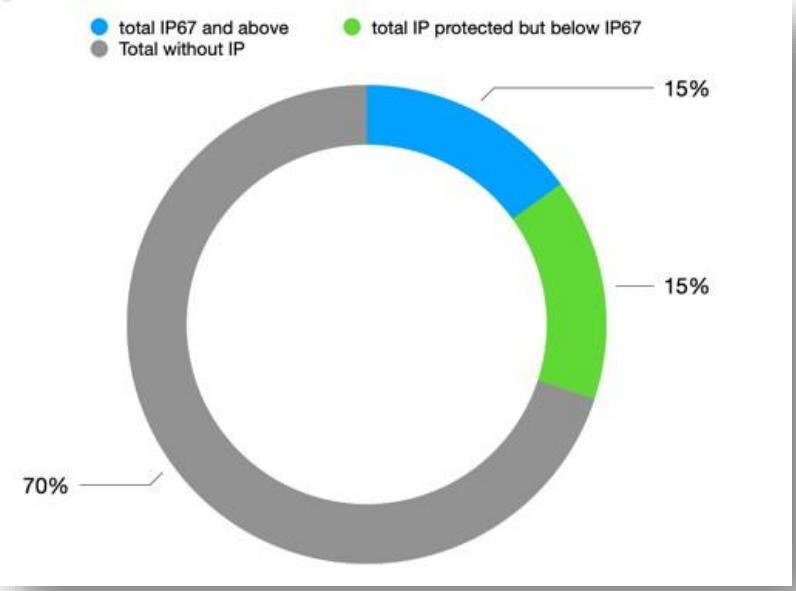
[5] Stahl et al., *Assessment of options to improve particular aspects of the EU regulatory framework on batteries – final report*, 2021, available at https://data.europa.eu/doi/10.2779/432234.

[6] Carbon footprints are difficult to measure and compare, but DIGITALEUROPE members report carbon footprints for their smartphones between 22kg CO2 and 85kg. Estimate based on a conservative approximation of 65kg of CO2 per smartphone.

[7] Laitala et al., 'Increasing repair of household appliances, mobile phones and clothing.'

[8] US survey data. SWD (2023) 101 final. Another study in 2018 identified 35% of smartphone failures related to water ingress. See Cordella et al., 'Durability of smartphones: a technical analysis of reliability and repairability aspects,' *Journal of Cleaner Production*, March 2021.

smartphones and tablets stated that 47 per cent of all smartphones in 2019 were IP rated but did not provide a nuanced view of IP levels on the market.[9] Out of 864 smartphone models launched between 2020 and 2024, 15 per cent were IP protected between IPx4 and IPx6 and another 15 per cent were protected at IPx7 or above.[10]



The ecodesign impact assessment for smartphones and tablets assumed that IP protection would reduce failure rates by 50 per cent. Internal data from DIGITALEUROPE manufacturers indicates that this number is vastly underestimated. Apple, for instance, recently released a white paper indicating that when liquid ingress protection was introduced with iPhone 7, repairs for liquid damage decreased by 75 per cent.[11] In other words, it makes sense to incentivise the market to implement strong liquid ingress protection to deliver on the benefits for consumers and the environment.

Durability increases with an integral design approach

***78% reduction** of in-warranty repair rate between 2015-2022*

Modern smartphones use lithium-ion soft pouch batteries, which allow a high energy density concentration in a relatively small form factor. The enclosure of

[9] SWD (2023) 101 final.

[10] Based on data aggregated from www.devicespecifications.com. For the analysis, 864 models launched by Samsung, Apple, Xiaomi, OPPO and Vivo in the period of 2020-2024 were assessed by DIGITALEUROPE.

[11] Apple, *Longevity, by Design*, June 2024, available at https://support.apple.com/content/dam/edam/applecare/images/en_US/otherassets/programs/Longevity_by_Design.pdf.

the smartphone doubles as a protecting shield for the soft pouch and makes an additional encasing superfluous. The enclosure, together with an adhesive-based fastener design strategy for the screen, ensures an efficient heat management of the batteries, protects batteries during drops, and enables high levels of liquid ingress protection. Preparatory work for the ecodesign impact assessment for smartphones and tablets did not quantify it, but acknowledged that this design 'tends to increase battery lifetime.'[12] This statement is in line with findings from the Commission-funded PROMPT project, which identified five design recommendations for physical durability of products, including the need to: block, i.e. shield from environmental variation such as thermal insulation or water; distribute, i.e. evenly distribute thermal or mechanical stress; dissipate, i.e. dampening against shock and vibration; and endure, i.e. to resist mechanical or thermal causes.[13] All of these functions are fulfilled with an embedded battery design.

The main difference between the batteries and the ecodesign regulation for smartphones and tablets in terms of design constraints is the disallowance to use thermal energy to enable a repair. Thermal energy is required to defeat adhesives that ensure protection against liquid ingress. The introduction of IP rated protection against liquid ingress requires the addition of adhesives, seals and gaskets that make repair more complex. However, the introduction of high levels of liquid ingress protection dramatically reduces one of the most prevalent modes of failure in smartphones. As previously illustrated, this design avoids tens of millions of units seeing a premature end of life and turning into waste. Apple, for instance, has seen a reduction of in-warranty and out-of-warranty repair rates between 2015 and 2022 of 78 per cent and 38 per cent respectively, whilst devices last longer and remain in use for a longer period of time.[14]

Batteries that last longer decrease smartphones' environmental impact

50% increase *in life expectancy reduces environmental impact by 33%*

Fraunhofer IZM, the authors of the ecodesign impact assessment for smartphones and tablets, explain it as follows:

> *Long battery life is the most important feature in smartphones for prospective buyers. … Installing batteries with higher capacity results in increased battery life and therefore, even as the batteries age, the battery life may remain to be acceptable to the user for a longer period of time. Higher battery capacity therefore may postpone a limiting state*

[12] Schischke et al., *Ecodesign preparatory study on mobile phones, smartphones and tablets – final report*, February 2021.

[13] Dangle et al., *Design for physical durability, diagnosis, maintenance and repair. PROMPT – premature obsolescence multi-stakeholder product*, 2023.

[14] Apple, *Longevity, by Design*.

> *in which the decreased battery life is insufficient to the user and results in repair (battery replacement) or replacing the device with a new unit. … Higher battery capacity may also decrease the charging frequency and therefore the number of charging cycles is stretched out over a longer period of time, which enhances product lifetime.*[15]

The ecodesign requirements for smartphones and tablets incentivise durability-focused designs. The impact assessment for smartphones and tablets assumes that an increased battery endurance of 20 per cent from 500 to 600 cycles 'shifts the point in time where the battery reaches a critical status by approx. 0.5 years thus overall extending product life.'[16] The impact assessment showed that for high-end smartphones, durability and repairability scenarios at this juncture were on par. As the final requirement establishes a minimum of 800 cycles and a high threshold for professional replaceability of 1,000 cycles, it is safe to assume that the case for the durability scenario gets even stronger with tougher longevity requirements. Assuming a linear improvement, extending the endurance from 800 to 1,000 cycles would result in a 25 per cent longer nominal device lifetime.

In a 2015 study, the Green Alliance found that batteries carry 2-3 per cent of embedded carbon of a device, but that one additional year of usage can reduce a smartphone's overall carbon footprint by 19-31 per cent.[17] A 2023 study for the National Institute of Standards and Technology found that if 'a product's life expectancy increases by 50%, it decreases the needed replacements and commensurate environmental impacts by approximately 33%. A 100% increase in life expectancy reduces needed replacements and commensurate environmental impacts by 50%, if products are used to their end of life.'[18]

Durability with professional repairability delivers the best of two worlds

***70%** of smartphones still work when replaced*

The ecodesign requirements for repairability and durability allow for a more robust and industry driven solutions to increase environmental protection. This is possible by allowing a more flexible approach to repair and removability compared to the batteries regulation. It is a misleading binary approach to assume that repairability and design for durability cannot be reconciled. Instead, it is important to find smart compromises to resolve the trade-offs that are involved in the design of smartphones. Sometimes, professional

[15] P. 414, SWD (2023) 101 final.

[16] Ibid.

[17] Benton, Coats and Hazell, *A circular economy for smart devices: opportunities in the US, UK and India,* Green Alliance, 2015, available at https://green-alliance.org.uk/wp-content/uploads/2021/11/A-circular-economy-for-smart-devices.pdf.

[18] Thomas, '*Cost-effective environmental sustainability. A focus on the Circular Economy*,' National Institute of Standards and Technology Advanced Manufacturing Series, NIST AMS 100-48-upd1, 2022, updated as of May 2023.

repairability (including the use of thermal energy) ensures a user can get a device repaired, whilst also benefiting from new durability features like long-lasting batteries and high levels of protection against liquid ingress. This has real impact in prolonging product lifespans and avoiding devices to prematurely become waste.

Durability is required by the ecodesign requirements and can be guaranteed through various international testing standards:

- Drop tests, e.g. with IEC 60068-2-31:2009, Method 516.7 of MIL-STD-810H, TCO Certification;
- Display scratch resistance, e.g ISO 1518-1, ISO 1518-2;
- Water and dust proof tests, e.g. IEC 60529 (IP protection); and
- Battery endurance tests, e.g. IEC EN61960-2 3017, ECMA 383.

Due to the strong durability characteristics of smartphones, several studies consistently show that 'forced replacement' is rare as approximately 70 per cent of smartphones are still working when they are being replaced.[19] The reasons for replacement are manifold: a 2022 study identified 19 different replacement reasons, with six related to the decreased value of the old product but 13 related to heightened value of a new product.[20] A 2023 Deloitte study in Germany quantified that 47 per cent of consumers replace a defective product rather than repairing it.[21] and academic literature points to repair being a complex socio-cultural decision-making process.[22] In light of these findings, it is important to enable a second or even third life for smartphones by design for durability.

Designing for durability ensures that all smartphone users in Europe can benefit from it. Designing for repairability is important for those consumers who belong to the 30 per cent whose phone needs a repair. We believe the best way to deliver durability without compromising on repair is to enable professional

[19] Wieser and Troeger, 'Exploring the inner loops of the circular economy: replacement, repair and reuse of mobile phones in Austria,' Journal of Cleaner Production 172, 2018.

[20] Magnier and Mugge, 'Replaced too soon? An exploration of Western European consumers' replacement of electronic products,' Resources, Conservation and Recycling 185, 2022.

[21] Choe, Wege and Seidel, 'Right to repair: revolutionising throwaway culture,' Deloitte Insights, December 2023.

[22] Lefebre, 'To repair or not to repair: an investigation of the factors influencing prosumer repair propensity.' Doctoral dissertation, Loughborough University 2019. Makov and Fitzpatrick, 'Is repairability enough? big data insights into smartphone obsolescence and consumer interest in repair,' Journal of Cleaner Production 313 2021. Makov et al., 'What affects the secondhand value of smartphones: evidence from eBay,' Journal of Industrial Ecology 23 (3), 2019. Roskladka, Jaegler and Miragliotta, 'From "right to repair" to "willingness to repair": Exploring consumer's perspective to product lifecycle extension,' Journal of Cleaner Production 432, 2023. Russell et al., 'A matter of timing: system requirements for repair and their temporal dimensions,' Journal of Industrial Ecology 00, 2022.

repairability where possible, and incentivising long-lasting batteries and liquid ingress protected designs.

Furthermore, a study published in the Environmental Science and Pollution Research journal highlights the challenges associated to user behavior and compliance with municipal and regional recyclability laws.[23] According to the study, many consumers often fail to comply with proper disposal methods for electronic waste, including batteries. The authors found that "although general awareness exists among consumers about the negative impacts of improper disposal, this awareness was not reflected during the disposal of waste batteries…Insufficient knowledge about waste battery collection points and convenience were the most important factors affecting the inappropriate disposal behavior from most of the consumers". Professional repairability, on the other hand, requires strict business infrastructure and resources in place for proper recycling of batteries as per the municipal and regional legislation and requirements, which also prevent dispersion of critical and hazardous materials contained in batteries.

Lex specialis principle

In addition to the data points presented in this paper, we highlight a strong legal aspect underpinning the supersedure of the ecodesign regulation for smartphones and tablets over the batteries regulation, i.e. the *lex specialis* principle. The batteries regulation is a *lex generalis* that regulates batteries in a horizontal way. The European Court of Justice has stated several times that: 'in accordance with the principle *lex specialis derogat legi generali*, special provisions prevail over general rules in situations they specifically seek to regulate'[24].

The ecodesign regulation for smartphones and tablets and the batteries regulation were negotiated in parallel. Therefore, the *lex specialis* principle is further reiterated in:

- Art. 11(1) and recital 38 of the batteries regulation, which explicitly call for more specific rules: 'The general provisions of this Regulation […] could be complemented with requirements laid down for particular products powered by batteries under implementing measures under Directive 2009/125/EC'[25], i.e. the ecodesign regulation for smartphones and tablets.
- The impact assessment for smartphones and tablets, which specifically states: 'The Ecodesign requirement on the disassemble-ability of batteries […] could be considered as *lex specialis* related to the

[23] Md T Islam, N. Huda, A. Baumber, R. Hossain, V. Sahajvalla, 'Waste battery disposal and recycling behavior: a study on the Australian perspective', Environmental Science and Pollution Research (2022), 29: 58980-59001

24 Case T-60/06 RENV II

25 Regulation 2023/1542

batteries of mobile phones and tablets. It addresses in greater detail the proposed batteries regulation's general requirement for removability and replaceability. [Ecodesign regulation] 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.'[26]

If the batteries regulation was to take precedence over the ecodesign regulation for smartphones and tablets, it would effectively declare Art. 5(c) of Annex II, Part B of the ecodesign regulation null and void.

Conclusion

Durability should be prioritised as a design requirement whenever possible: it is measurable and its outcomes can be relied upon. It is key not to deviate from the draft batteries regulation guidance document the Commission consulted stakeholders on,[27] and to maintain the clear indication that smartphones and tablets replaceability is regulated under the more specific ecodesign rules, rather than the product-agnostic batteries regulation.

FOR MORE INFORMATION, PLEASE CONTACT:

Giorgia Murgia

Manager for Sustainability Policy

giorgia.murgia@digitaleurope.org / +32 493 25 89 46

Raphaëlle Hennekinne

Policy Director for Sustainability

raphaelle.hennekinne@digitaleurope.org / +32 490 44 85 96

26 European Commission Staff Working Document Impact Assessment Report for the 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, SWD (2023) 101 final, 16.06.2023

27 The draft Commission Notice establishing guidelines to facilitate the harmonised application of the batteries regulation was presented by the European Commission during the 6 March expert group call on the implementation of the batteries regulation. It has not been made public. A final version is expected by autumn 2024.

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DIGITALEUROPE is the leading trade association representing digitally transforming industries in Europe. We stand for a regulatory environment that enables European businesses and citizens to prosper from digital technologies. We wish Europe to grow, attract, and sustain the world's best digital talents and technology companies. Together with our members, we shape the industry policy positions on all relevant legislative matters and contribute to the development and implementation of relevant EU policies. Our membership represents over 45,000 businesses that operate and invest in Europe. It includes 108 corporations that are global leaders in their field of activity, as well as 41 national trade associations from across Europe.

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