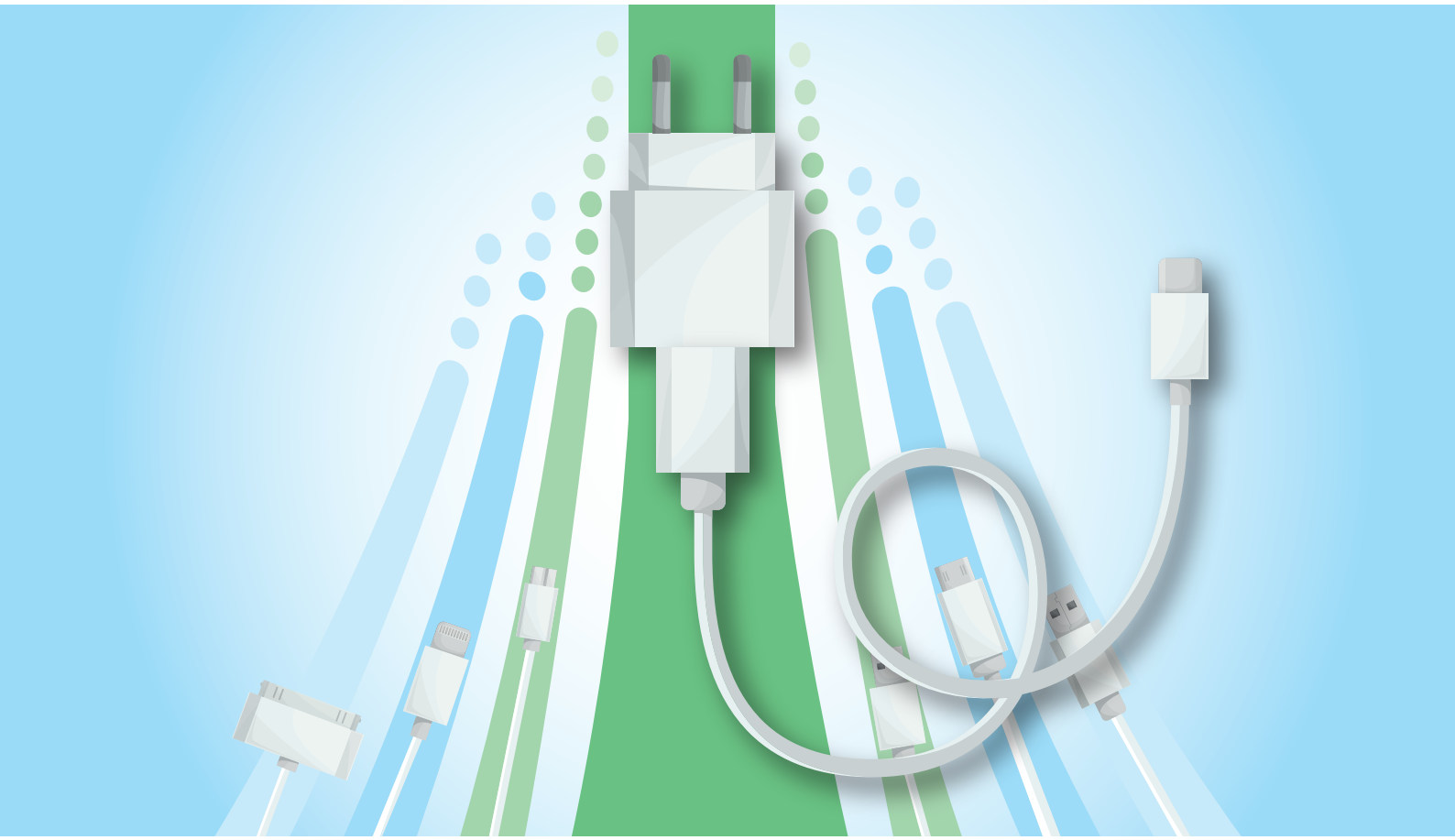
ONE CHARGER TO FIT THEM ALL

USING ECODESIGN TO DELIVER AN AMBITIOUS COMMON CHARGER INITIATIVE



ECOS

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EXECUTIVE SUMMARY

An estimated half a billion chargers are shipped for portable devices in Europe each year[1] – and many of these are duplicates of chargers consumers already have at home.

While voluntary initiatives on smartphone chargers have been successful to a certain extent, allowing for a shift from 30 different connectors to three predominant options, the environmental goal of reducing the volume of chargers produced remains unattained. Nearly all manufacturers of portable products continue to ship their goods with a charging cable, and for smartphones, tablets and laptops, including both the charger plug and the cable remains standard practice.

This report contributes to the ongoing policy debate on the best way forward towards achieving the objectives of the newly announced common charger initiative. It determines the reasons behind past policy failures and examines the technology trends, considering how these are likely to impact consumers, the market and the environment in the future.

A policy approach focusing solely on the introduction of a single connector would not be sufficient to address the environmental impact or consumer inconvenience arising from wasteful proliferation of charging solutions. What is needed instead is a shift in focus in terms of policy instrument and a comprehensive policy intervention addressing the full range of risks related to the continued market fragmentation.

We put forward a package of innovative ecodesign policies which, if implemented, could result in savings of around 29,000 tonnes of e-waste per year, as much as over 70 International Space Stations would weigh if put together. In addition, it would also reduce the associated greenhouse gas emissions by over 1,800 kilotonnes of CO_2 equivalent, which corresponds to some 1 million cars being taken off our roads.

We argue that instead of relying on the Radio Equipment Directive, which to date has been considered the go-to legislative instrument for the common charger initiative, the European Commission should revise the dedicated Ecodesign Regulation on external power supplies. This should be accompanied by an associated Standardisation Request to the European Standardisation Organisations.

Such an approach would not only allow to build on recent technological developments and significantly expand the scope of the initiative to a whole range of different products – from laptops to loudspeakers – but also address the continued practice of packaging products together with chargers by default or the need for increased efficiency of the ever more popular wireless charging solutions.

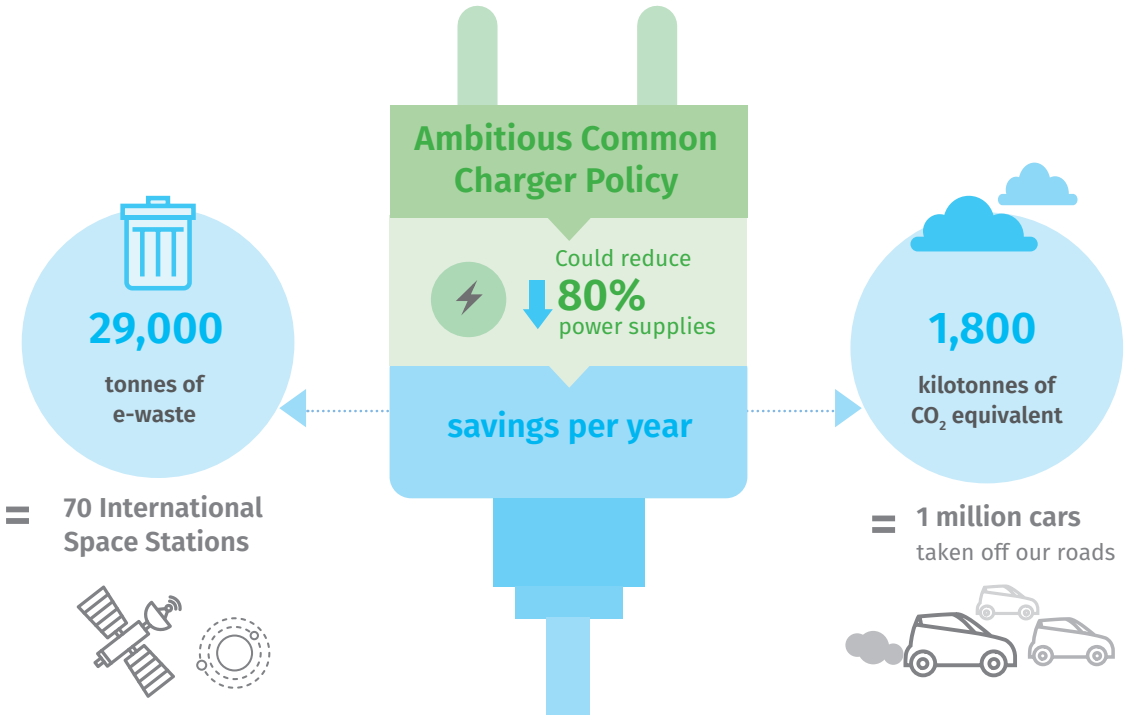
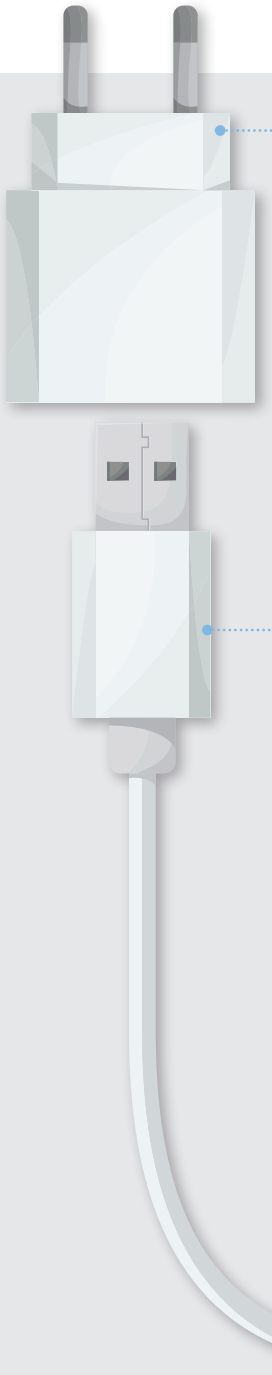


Figure 1: Estimated savings to be achieved if an ambitious common charger policy is implemented

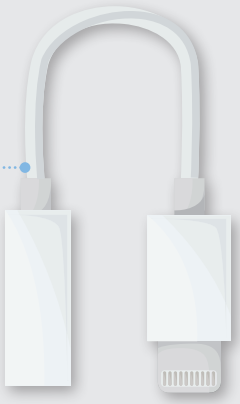
What is what?

A charger dictionary



Charger plug

the part of the charger that plugs into the wall, sometimes referred to as the “brick”



Adaptor

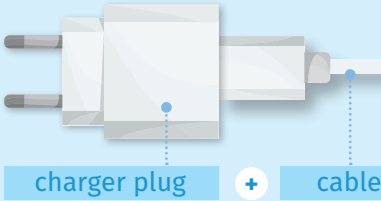
refers to a device that is used to convert one type of end connector to another, such as to convert a USB-C connector to a proprietary Lightning connector

Connector

there are two connectors on a cable – one slots into a port on the charger plug, the other in the port on the product to be charged

Cable

connects the charger plug to the product for charging; usually, cables can be disconnected from the charger plug, and thus have a connector on either end



Charger

includes the charger plug and the cable. Sometimes it is also referred to as a “power adaptor” or “(external) power supply”

The quest for a common charger:

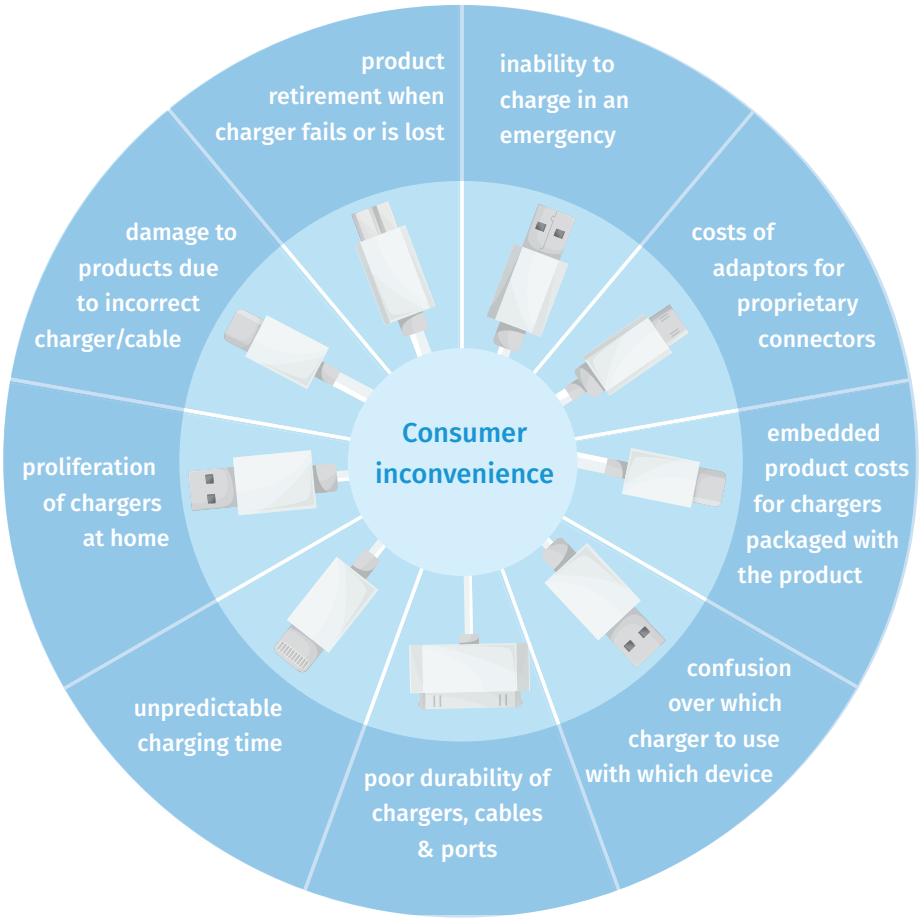
AN OVERVIEW OF THE POLICY CONTEXT

In 2009, half a billion mobile phones were in use across EU countries, using more than 30 different types of charging solutions.[2] This resulted in a build-up of different chargers in households, which would either be discarded once the phone was no longer in use, or stored away in hibernation.

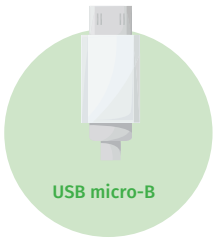
To address both the waste impacts and inconvenience caused to consumers, the European Commission requested that mobile phone manufacturers introduce a voluntary initiative to harmonise their charging approaches. A Memorandum of Understanding (MoU) was signed in June 2009, in which manufacturers agreed to harmonise chargers for smartphones placed on the EU market from 2011 onwards. The MoU, which expired in 2014, resulted in an eventual reduction of the different charging solutions down to three main connectors in use today: USB micro-B, USB-C and the proprietary Lightning connector. Approximately 75% of the market has shifted to use standardised USB connectors on their smartphones.[3]

However, despite this apparent success, some manufacturers profited from the continued use of proprietary connectors through the sales of cables, adaptors and licensing. Five of the top ten bestselling Apple products in 2018 were adaptors or cables for the proprietary Lightning connector.[4]

What is more, around a quarter of smartphone cables today remain non-interchangeable, and the design of chargers and connectors for other portable products also tends to vary widely. As a result, 84% of smartphone users have experienced problems related to their phone chargers in the last two years.[5] An overview of current consumer problems related to portable device chargers is provided below.



Three main connectors used for smartphones today



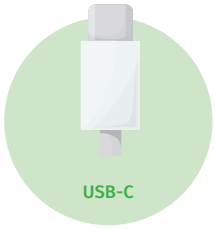


Figure 2: Consumer inconvenience due to the lack of a common charger

In addition, shipments of chargers and cables together with smartphones have continued completely unhindered, with the e-waste issue remaining essentially unaddressed. Today, only Fairphone ships phones without power supplies in the EU – a manufacturer with a market share below 0.1%[6].

This results in a situation where smartphone chargers alone generate some 11,000 to 13,000 tonnes of e-waste each year across the European Union, with the associated life cycle emissions of around 600-900 kilotonnes of CO_2 equivalent.[7] If we also add chargers for other portable products such as laptop computers, which continue to be characterised by a diversity of connectors, this number triples and goes up to well over 35,000 tonnes of e-waste per year, with the associated yearly greenhouse gas emissions of over 2,200 kilotonnes of CO_2 equivalent.

At present, there are no voluntary commitments or binding requirements on common chargers for smartphones or other portable devices. The commitments under the MoU expired in 2014, and the negotiations aimed at defining a new set of pledges, which would take into account technological developments, were unsuccessful.

In view of the above, in January 2020 the European Parliament adopted a resolution calling on the European Commission to introduce a common charger as *a matter of urgency in order to avoid further internal market fragmentation.*[9]

As a direct reaction to these calls, the European Commission announced in its 2020 Work Programme that in the third quarter of 2020[10] it would put forward a legislative proposal on a common charger for smartphones and similar devices - an initiative which was later postponed to the first quarter of 2021 and which is, therefore, still pending.[11]

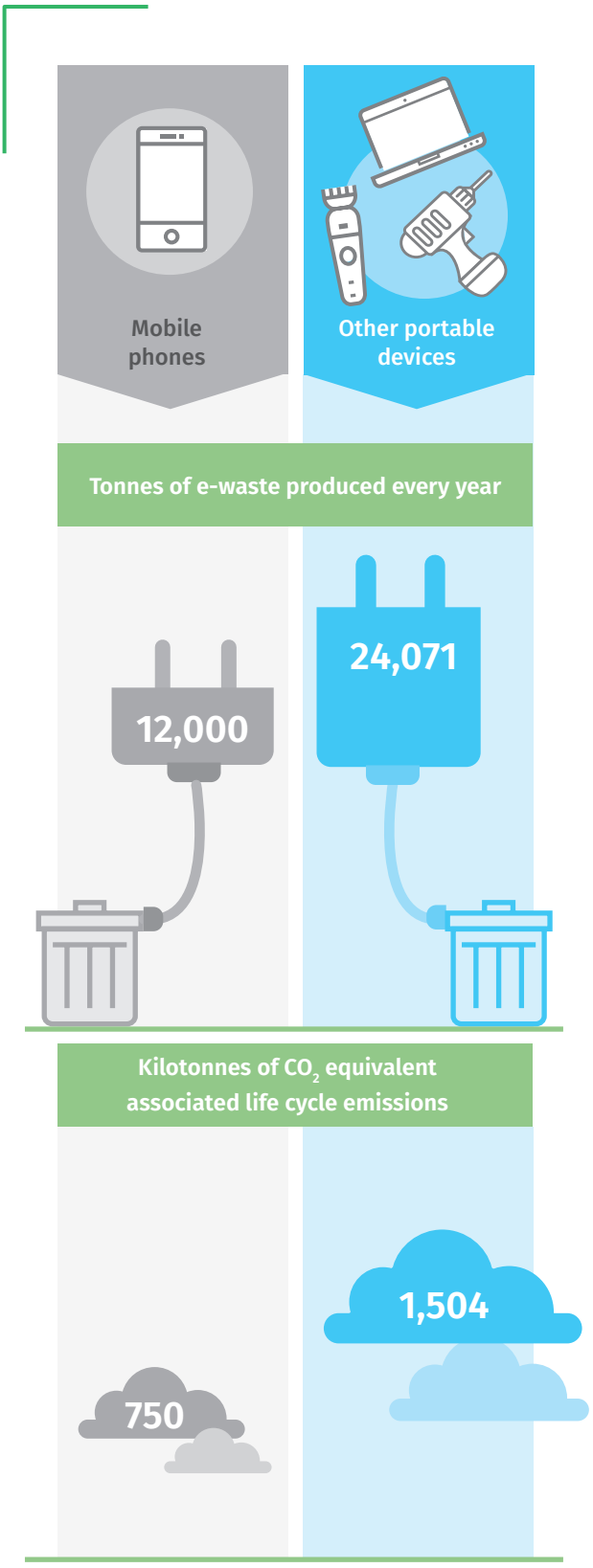


Figure 3: Environmental impacts due to lack of a common charger policy[8]

Steering innovation towards positive outcomes:

AN OVERVIEW OF TECHNOLOGY TRENDS

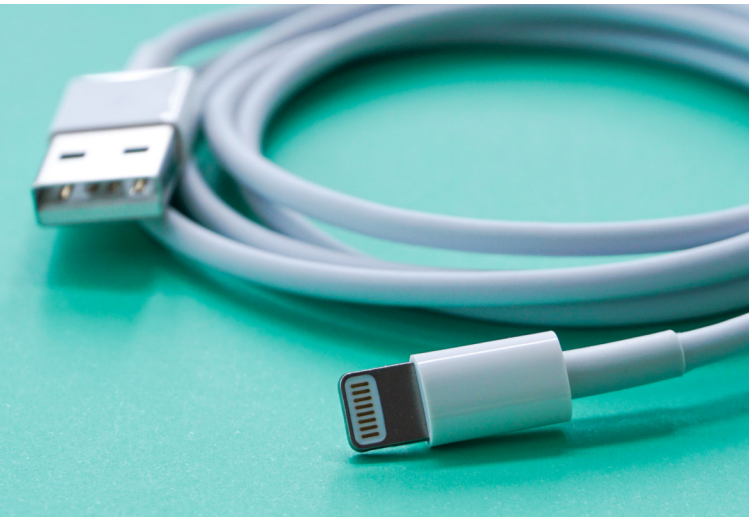
Since 2014, when the Memorandum of Understanding expired, technological developments have made a common charger feasible not just for smartphones, but for a whole range of portable devices. In particular, four technological trends are worth highlighting here.

1 USB power delivery (PD) protocols

Firstly, a step change is underway for USB-C connectors. When these are equipped with USB power delivery (PD) protocols (of the USB 3.1 standard or higher[12]), the voltage supplied via the charger can vary depending on the requirements and specifications of the charged device, with it simply informing the charger about the required voltage.

This means that a phone – or any other product – can be safely charged with a powerful laptop power supply. In fact, this technology allows all consumer devices to be charged using a single charger, without the need for multiple cables or power supplies, and thus has the potential to completely eliminate the need to ship the charger together with the device.

USB-C connector on a smartphone



Charging cables

2 Charging cables are now usually separable

Secondly, charging cables are now usually separable from the charger plug that connects to the alternating current (AC) power source. This means that if a connector fails, the whole External Power Supply need not be replaced but only the cable.

USB-C ports

Thirdly, most new Android phones, as well as the latest Apple products, such as the iPad Pro and the MacBook, now feature USB-C ports. Newer iPhones, meanwhile, use cables with a USB-C tip on one end, although still join to the handset using the proprietary Lightning connector.

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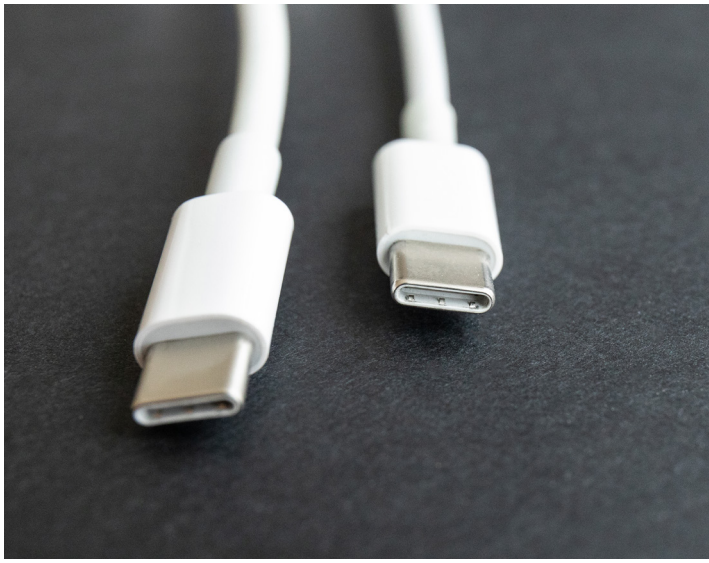

USB-C connectors

Wireless charger

4

Wireless charging

The last trend in charging is the shift from connected to wireless charging. Currently around 29% of portable device users claim to have used this charging solution,[13] and the main wireless charging standard Qi is supported by many new phones, including models from Apple, Samsung, Google and LG.

Wireless charging requires an induction coil or pad which is connected to the mains via a charger plug. To date, this technology has performed less efficiently than wired charging, making the charging time longer. However, no standardised test method exists to evaluate and effectively compare the efficiency of wireless charging.

Risky business:

WHY A COMPREHENSIVE COMMON CHARGER INITIATIVE IS NEEDED MORE THAN EVER

While recent technological developments present a number of opportunities, they also come with significant risks that could severely impact consumers if not addressed through common charger policy measures.

Without the necessary policy intervention, the gradual shift towards USB-C connectors with corresponding USB 3.1+ power delivery protocols will not occur consistently, and companies will continue to draw unfair profits from their proprietary charging solutions.

Moreover, even with the majority of charging solutions appearing physically homogeneous if we harmonise the connector, it is clear that the protocols and the associated functionalities each cable supports will continue to vary widely.

Without addressing minimum power delivery and introducing a common fast charge functionality, or informing consumers about the wattage range, data transfer speeds or the presence of the display connection capability consumers will easily become confused and frustrated with these new solutions – and once again find themselves overwhelmed by a proliferation of different cables and chargers.

At the same time, while it is expected that some charging will shift to wireless in the future, it is paramount to ensure that the wireless charger is equally energy efficient as a wired solution and that it is interoperable – capable of charging different devices regardless of their manufacturer.

All these risks are discussed in greater detail below.

OPPORTUNITY	THREAT
Separation of cable and charger	Counterfeit and/or old cables with USB-C connector but not compliant with USB 3.1+ protocols
Ability to charge multiple products requiring different voltages from the same charger	Variations in charger and cable power ratings
Increasing prevalence of USB-C ports in products	Variations in charger plug and cable functionality (e.g. fast charge, data transfer)
Shift toward wireless charging alternatives	Limitations in wireless fast-charging interoperability

Figure 4: Summary of charger technology opportunities and threats

1. Use of counterfeit or old cables without USB power delivery protocols (USB-PD)

A cable can have a USB-C connector, yet the cable itself may not be compliant with USB 3.1 protocol or above. Likewise, a charger may have a USB-C port but not operate using the power delivery protocols. In such cases, the voltage may not be properly controlled, and charging may not function correctly, for example:

- A high-powered charger used with a low-powered device could lead to the device burning out, or
- A low-powered charger used with a power-hungry device could lead to the burn-out of the port or charger.

Such scenarios could result in the premature obsolescence of chargers or entire electronic products due to the unregulated voltage flows, port- or other failures. Consumers could become fearful of such incidents, and insist on cables and chargers being coupled with devices regardless of the potential to use the chargers they already have for new products.

2. Variations in charger and cable power ratings

Although USB-C coupled with the power delivery protocols can enable a product to be used with a wide range of chargers, not all chargers will have the same performance, which is likely to result in consumer confusion and inconvenience. For the quickest charge, consumers will need to ensure their charger is specified at least at the rated power recommended for their device. Meanwhile, for higher-powered devices such as laptops, a thicker cable may also be required for an optimal charge.

This is likely to lead to consumers feeling disappointed with charging times, and result in an increased demand for chargers and cables to be shipped with the product.

3. Variations in additional charger plug and cable functionality

The USB protocols allow for different “modes” in the cables such as:

- Power delivery only;
- Power and data delivery, at varying speeds depending on design;
- Power, data and display delivery.

Without a clear marking approach, consumers may find themselves with multiple USB-C cables, unable to identify the one they need for a specific application. Besides the USB protocol, manufactures can add different features to charger plugs to ensure the fastest possible charge for their specific device.

Due to the range of proprietary fast charging protocols available, users could experience significant variations in charging performance between brands and devices. These variations in cable and charger plug functionality could fuel a second wave of excess chargers and cables, with the corresponding environmental impacts and hidden costs to consumers.

4. Limitations in wireless fast charging interoperability

Although the majority of the market appears to have converged on the Qi wireless charging standard, there is nothing that prevents manufacturers from diverging and starting to use other wireless standards in the future.

In addition, even when the devices produced by different manufacturers all use the Qi standard, there is a risk that they develop tailored fast charging protocols to enhance the charging process for their specific device – similarly to the case of wired chargers. This means that for the fastest charge of a smartphone, it may be necessary to use the wireless charger made by the same manufacturer, once more creating a need for multiple chargers at home.

A package to address the environmental challenge:

THE BEST WAY FORWARD

A pragmatic approach is necessary to minimise the environmental impact of portable product chargers, and it can be achieved via a comprehensive package of complementary common charger policies - challenging as the current situation is. Only through an integrated approach can the market inequalities be corrected, and the environmental savings potential of USB-C/USB-PD realised.

This paper puts forward an overview of a proposed common charger initiative, which would address not only charging solutions for smartphones, but also a much broader group of products. In addition, it would tackle the problem related to the lack of a single standardised connector, as well as the broader issue of chargers being packaged together with products by default.

Scope of legislative intervention

It is essential that a wide range of portable devices is addressed via the common charger initiative, going well beyond what is possible under the Radio Equipment Directive, which to date has been considered as the go-to legislative instrument of the European Commission. This would not only optimise the environmental benefits, but also significantly reduce market fragmentation.

Almost all smartphones, tablets, laptops, digital cameras and battery-operated videogame devices are currently sold with a cable and charger plug, while nearly all small devices including action cameras, e-readers and wearables are sold with a cable. Therefore, there is a tremendous potential for environmental savings if we manage to decouple chargers and cables from these products.

The new initiative should cover all portable products that consume less than 100W, as illustrated here and for the most part already covered by the scope of the existing ecodesign regulation on external power supplies:

Figure 5: Types of devices that could and should be charged with a single common charger

Contents of the new common charger initiative

The new common charger initiative ought to comprehensively address the current regulatory void in relation to portable chargers. In order for environmental savings to be fully realised, the policy intervention should therefore go well beyond the standardisation of connectors.

With a significantly enlarged scope, the new common charger initiative should also address the continued practice of selling chargers together with products by default, the increasing fragmentation of different functionalities of chargers, as well as the possible future limitations in both the efficiency and interoperability of wireless charging solutions.

The main elements to be addressed are summarised below – alongside the outline of the expected impact of such regulatory intervention. This is then translated into a concrete proposal for a targeted legislative review of the Ecodesign Regulation on external power supplies, which can be found in the Annex of this paper.

Together with the adoption of that review, the European Commission should issue a standardisation request to the European Standardisation Organisations for the enabling technical specifications to be developed. These could include a common standardised specification of fast charge protocols or modes available on a given charger, such as data or display capability.

Measure	Mechanism[1]	Impact
Decoupling charger and cable are not packaged with the device, and are only shipped with the product if directly requested by the consumer. Supported by: • **Product-level information requirements** to ensure consumers are informed about the type of charger that is recommended, and on how to safely charge their device. • **Information campaign** to manage consumer expectations and explain that chargers and cables should be purchased separately when the measure comes into force. • **Testing standard updates** to allow the manufacturer to test products only with the power supply recommended for a given product.	Targeted amendment to the Ecodesign regulation on external power supplies	• Guaranteed environmental savings in terms of materials, greenhouse gas and other emissions, and electronic waste. • Reduced costs for consumers, due to discounting of the price of unnecessary adaptors from product prices. • Reduced consumer inconvenience arising from unnecessary multiple chargers.

1 The exact wording of the legislative amendmentt to the Ecodesign regulation on external power supplies (Regulation 2019/1782) is proposed in the Annex of this document.

Measure	Mechanism	Impact
Standardised connectors and minimum power delivery protocol to be supported wired charger connectors are specified to be USB-C with USB 3.1 protocol or higher.	Targeted amendment to the Ecodesign regulation on external power supplies	• Removes the need for proprietary connector adaptors and brings about corresponding savings in terms of consumer cost as well as environmental impacts. • Reduces market fragmentation and enables a level playing field. • Prevents potential safety issues with non-USB 3.1 protocol cables. • Reduces consumer complaints arising from the lack of a common charger. • Avoids innovation lock-in as wireless charging is an alternative, plus innovation will occur via USB-PD protocols on which there is flexibility for new versions.
Standardised fast charge protocol all chargers are harmonised in relation to the fast charge approach.	Targeted amendment to the Ecodesign regulation on external power supplies supported by the specification of transitional methods and a standardisation request issued by the European Commission to European Standardisation Organisations.	• Ensures greater consistency of charging performance across different cables and chargers. • Prevents proliferation of incompatible multiple chargers and cables.

Measure	Mechanism	Impact
Standardised marking of chargers and cables[2] marking on product connector and on mains plug that shows compliance with USB 3.1 or above, and indicates available modes (data capability & speeds, power rating, display capability, compatibility).	Targeted amendment to the Ecodesign regulation on external power supplies supported by the specification of transitional methods and a standardisation request issued by the European Commission to European Standardisation Organisations.	• Prevents proliferation of incompatible multiple chargers and cables. • Reduces the need for consumers to request charger/cable to be shipped with the device. • Protects from poor quality cables/ chargers that could damage ports and products.
Efficient wireless alternatives wireless charging solutions are specified to meet the minimum requirements of the Ecodesign regulation on external power supplies	Targeted amendment to the Ecodesign regulation on external power supplies	• Notable energy savings against a baseline business as usual scenario where wireless charging is neither tested nor mandated for efficiency. • Mitigates the risk that poor efficiency wireless chargers become the norm.

2 Note that the Certified USB Charger Compliance and Logo Program already certifies products and provides information on power delivery specifications, but the extent to which modes or data speeds are covered remains unclear. Moreover, hardware can still be certified below USB 3.1 protocol which could be confusing for consumers and result in damage to products. See www.usb.org for further details.

CONCLUSIONS

In this paper, we proposed a package of tailor-made policy recommendations to be implemented under the Ecodesign Regulation on external power supplies, which has the potential to both reduce market fragmentation and improve consumer experience.

Furthermore, assuming that a common charger policy will reduce the need for 80% of power supplies currently shipped with our smartphones and other devices, the savings brought about by a comprehensive decoupling policy would amount to approximately 29,000 tonnes of e-waste per year, as much as over 70 International Space Stations put together. In addition, the associated positive climate impacts would equal over 1,800 kilotonnes of CO_2 equivalent spared, which corresponds to some 1 million cars being taken off our roads.

A decoupling policy is essential for the environmental savings to be achieved, and this will not be accomplished with standardised connectors alone – as the now expired Memorandum of Understanding clearly demonstrated. Addressing decoupling via a dedicated Ecodesign Regulation enables a wider focus beyond smartphones, reducing market fragmentation and leading to major increases in environmental benefits. While it requires a shift in consumer expectations at the time of purchase, it also offers the chance to resolve many of the current issues consumers experience with portable product chargers.

The shift to USB-C / USB 3.1+ power delivery protocols offers endless opportunities for innovation, but as is often the case, it needs to be steered in the direction of cooperation and standardisation. Our policy recommendations ensure that innovation proceeds at its current pace, guided in a direction that is less harmful to the environment, and ensuring a level playing field for the market. Furthermore, the suggested implementation makes it possible to bypass the shift to USB-C connectors and move straight to innovative wireless solutions when needed.

What is clear is that with foresight and bold action, the European Commission can collaborate with the Member States, civil society representatives and manufacturers to create innovative technology and policy solutions that align with circular economy goals, and set an example on a global scale.

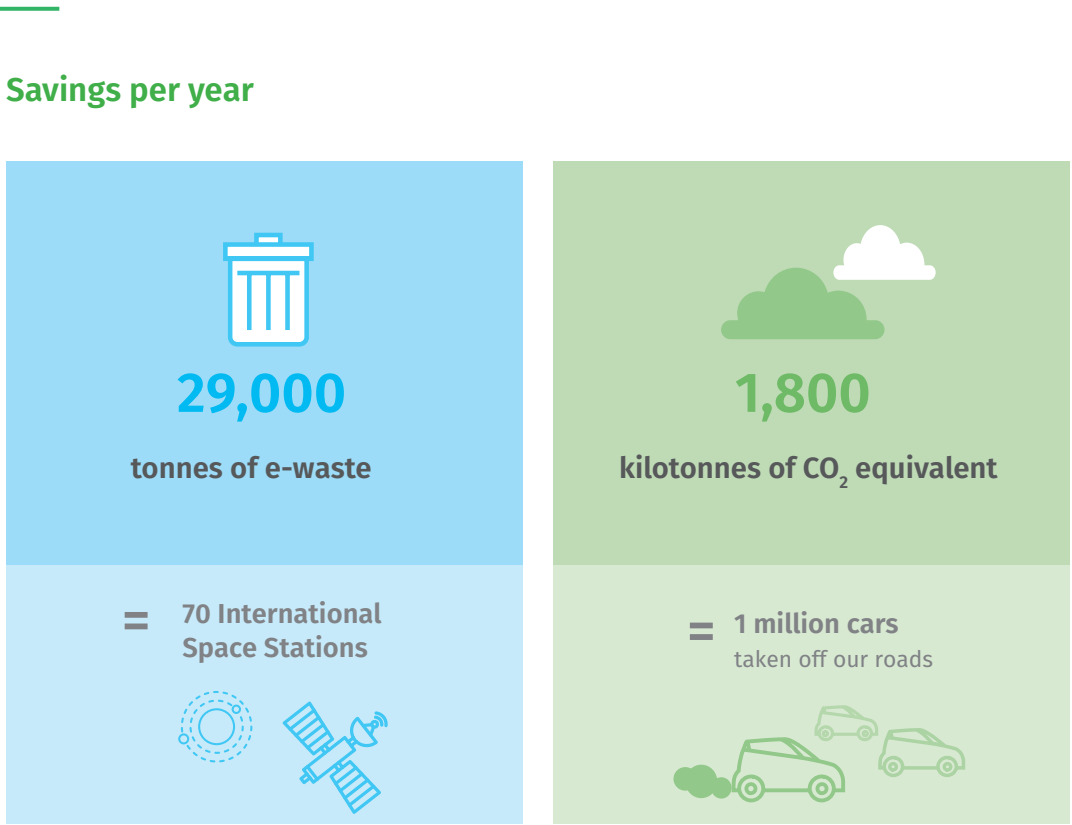

Figure 6: Estimated savings to be achieved if an ambitious common charger policy is implemented

Annex

A LEGISLATIVE PROPOSAL

for the review of the Ecodesign Regulation on External Power Supplies (Commission Regulation 2019/1782)

Bring wireless chargers into scope

Article 2
Definitions

For the purpose of this Regulation the following definitions shall apply:
(1) 'external power supply' means a device which meets all of the following criteria:
(d) it is connected to the device or devices that constitute the primary load with removable or hard-wired male/ female electrical connections, cables, cords or other wirings or ***by a wireless connection****;*

Bring a wider range of product chargers into scope

Article 1
Subject matter and scope
2. This Regulation shall not apply to:
~~*(g) docking stations for autonomous appliances;*~~

Annex 1
List of electrical and electronic household and office equipment

1. Household appliances:
- *Appliances for cooking and other processing of food, preparing beverages, opening or sealing containers or packages, cleaning, and maintenance of clothes,*
- *Appliances for hair cutting, hair drying, hair treatment, tooth brushing, shaving, massage and other body care appliances,*
- *Electric knives,*
- *Scales,*
- *Clocks, watches and equipment for the purpose of measuring, indicating or registering time.*
- ***Vacuum cleaners***
- ***Cordless tools such as screwdrivers, grinders and nail guns.***

*2. Information technology equipment, including **laptops, tablets, displays, e-readers, smartphones and other telecommunications equipment,** copying and printing equipment, and set-top boxes, intended primarily for use in the domestic environment.*

3. Consumer equipment:
- *Radio sets,*
- *Video cameras,*
- *Video recorders,*
- *Hi-fi recorders,*
- *Audio amplifiers,*
- *Home theatre systems,*
- *Televisions,*
- *Musical instruments,*
- *Other equipment for the purpose of recording or reproducing sound or images, including signals or other technologies for the distribution of sound and image other than by telecommunications.*

4. Electrical and electronic toys, leisure and sports equipment:
- *Electric trains or car racing sets,*
- *Game consoles, including hand-held game consoles,*
- *Sports equipment with electric or electronic components;*
- ***Wearable technology, including earphones***
- *Other toys, leisure and sports equipment.*

Include energy efficiency requirements for wireless chargers

Annex II
Ecodesign requirements for external power supplies

1. Energy efficiency requirements:

a) [edit column headings of table]

	*AC-AC external power supplies, except low voltage, **wireless** and multiple voltage output external power supplies*	*AC-DC external power supplies, except low voltage, **wireless** and multiple voltage output external power supplies*	*Low voltage external power supplies*	*Multiple voltage output **and wireless** external power supplies*

b) [edit column headings of table]

	*AC-AC external power supplies, except low voltage, **wireless** and multiple voltage output external power supplies*	*AC-DC external power supplies, except low voltage, **wireless** and multiple voltage output external power supplies*	*Low voltage external power supplies*	*Multiple voltage output **and wireless** external power supplies*

Include information requirements on USB power delivery specifications and USB modes

Annex II

Ecodesign requirements for external power supplies

2. Information requirements
b) from XXdateXX 202X, instruction manuals for end-users (where applicable), and free access websites of manufacturers, importers or authorised representatives shall include the following information, in the order as set out below:

[additional row]

Information published	*Value and precision*	*Unit*	*Notes*
USB power delivery level	***X.X***	***version***	***Version of the highest compatible USB power delivery specification [transitional reference: https://www.usb.org/usbc]***

b) [new section]
from XXdateXX 202X, the packaging of the external power supply shall display the following elements:
-- the compatible USB power delivery specification
-- the available modes (data capability & speeds, power rating, display capability).

Include interoperability requirements

[new section]
5. Decoupling requirements
from XXdateXX 202X external power supplies shall be placed on the market separately from the primary load product(s) they are intended to be used with.
Separately packaged power supplies shall be delivered with the primary load product(s) they are intended to be used with only when this is directly requested by the consumer.

Launch a standardisation request to address testing and marking requirements

To support the legislation, a standardisation request to European Standards Organisations needs to be launched as soon as possible to commence work on the following:

- Testing methods for wireless chargers
- USB power delivery testing, declaration and marking at product connector and at mains plug
- Harmonised fast charge protocol for wired and wireless EPS
- Product testing standard updates (for products listed in Annex I) to allow the manufacturer to test products only with the power supply recommended for use with the given product.

To support the proposed changes in the Regulation and allow sufficient time for standards to be finalised, transitional methods for the above can be published in the Official Journal of the European Union.

REFERENCES

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5 ***Impact Assessment Study on Common Chargers of Portable Devices***, 2019

6 ***Impact Assessment Study on Common Chargers of Portable Devices***, 2019

7 ***Impact Assessment Study on Common Chargers of Portable Devices,*** 2019

8 Estimates for average values, derived from the ranges specified in the ***Impact Assessment Study on Common Chargers of Portable Devices***, 2019

9 European Parliament resolution of 30 January 2020 on a common charger for mobile radio equipment

10 European Commission, Commission Work Programme 2020, COM(2020) 37 final

11 European Commission, Adjusted Commission Work Programme 2020, COM(2020) 440 final

12 EN-IEC 62680: 62680-1-3 addresses Type-C connectors, 62680-2-1 addresses USB specifications, 626801-2 covers power delivery

13 ***Half a Billion Smartphones and Other Devices with Wireless Power Technology Shipped in 2017***, IHS Markit Says (February 13, 2018) https://technology.informa.com/600120/half-a-billion-smartphones-and-other-devices-with-wireless-power-technology-shipped-in-2017-ihs-markit-says (consulted June 2020)

14 ***Impact Assessment Study on Common Chargers of Portable Devices***, 2019

15 ***Commission Regulation (EU) 2019/1782 of 1 October 2019 laying down ecodesign requirements for external power supplies pursuant to Directive 2009/125/EC***

ECOS is the only environmental organisation worldwide specialised in standardisation.

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