Product Circularity Report

Fairphone 3

2021

For discussion purposes only and produced for KPN

CIRCULAR IQ

MANAGEMENT SUMMARY

Fairphone 3

KPMG

Management Summary

The first step towards a circular economy is preserving resources and therefore promoting longevity. The Fairphone 3 aims to reach a lifespan of 5 years, which is about double the market average lifespan of smartphones. This is enabled by the modular architecture of the phone allowing for module upgrades and easy repair. The product system entails a phone and module take-back program which provides reusable or refurbished parts for repairs or input for recycling. Considering the opportunities for a positive environmental and social impact, material sources for the Fairphone 3 are chosen according to where the largest impact can be gained. The key recommendations and conclusions can be found below and this document serves as input for a dialogue to together work on these ambitions. Page eight is a glossary with terminology used in this report.

Carbon footprint production Fairphone 3

The carbon footprint of the production of the Fairphone 3 in its current design are 30.4 kg C02e per unit. For the purpose of this report we based our analysis on the LCA study performed by Fairphone and focused on the carbon improvements. By focusing efforts on lifetime extension and recycled content, the carbon footprint could be lowered to 20.98 kg C02e per unit. Potentially, this could save 9,400 kg of C02e on an annual basis based on illustrative number of 1,000 Fairphone 3 procured.

Material circularity score

Score breakdown

Outcome / 2
= circularity score

Inflow (27)[1]
%Recycled (27)
%Virgin rapidly renewable (0)

+

Outflow (73)*
%Recyclable (73),
%Compostable (0),
%Biodegradable (0)

[1] See page 5 for input / output graphs

Material circularity score

50%

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PRODUCT CIRCULARITY REPORT

This Product Circularity report provides an overview of the key circularity characteristics of this product. These characteristics are based on authorized information from company and its supply chain partners. It shows insights in key circularity supply chain information and provides transparency. For questions visit https://www.circular-iq.com/circularity

PRODUCT NAME
FAIRPHONE 3

by **FAIRPHONE**

SUPPLIERS CONTRIBUTED: **1**

DATE: **05 JANUARY, 2021**

56 Materials [1]

0.19 Weight of materials in kg

100 % of product weight accounted for

[1] The total number of different materials that are used is shown here. For reasons of simplicity, some of the materials that are in the Fairphone 3 have been aggregated in the following parts of the report. The '% of material source specified' is the overall % of recycled content of the Fairphone, while the position 'Material weight' is not, as there is more of these materials contained in 'PCB materials', which contains PCBs, connectors, resistors, chip inductors, capacitors of various materials.

PRODUCT CIRCULARITY BREAKDOWN

Material	Material safety	Material source	% of material source specified	Material weight
ABS	●	Virgin stream	100	0.0001 kg
Aluminum	●	Virgin stream	100	0.0018 kg
Cobalt (99% fair cobalt from DRC)	●	Virgin stream	100	0.01 kg
Copper	●	Recycled content	54	0.0281 kg
Copper-nickel-zinc alloy	●	Virgin stream	100	0.0031 kg
Diethyl Carbonate	●	Virgin stream	100	0.0036 kg
Ethylene Carbonate	●	Virgin stream	100	0.0030 kg
Fair Gold	●	Virgin stream	100	0.00001 kg
Fair Tin	●	Virgin stream	100	0.0024 kg
Fair Tungsten	●	Virgin stream	100	0.0001 kg
Glass	●	Virgin stream	100	0.0303 kg
Graphite	●	Virgin stream	100	0.0084 kg
Iron	●	Virgin stream	100	0.00002 kg
Lithium Hexafluorophosphate	●	Virgin stream	100	0.0014 kg

Material	Material safety	Material source	% of material source specified	Material weight
Magnesium aluminium alloy	● (orange)	Virgin stream	100	0.01 kg
Neodymium	● (orange)	Recycled content	89	0.0004 kg
PCB Materials	● (orange)	Recycled content	88	0.0196 kg
Polyamide	● (orange)	Virgin stream	100	0.0001 kg
Polycarbonate	● (orange)	Recycled content	40	0.033 kg
Polypropylene	● (orange)	Virgin stream	100	0.0001 kg
Propylene Carbonate	● (orange)	Virgin stream	100	0.0034 kg
Rubber	● (orange)	Virgin stream	100	0.0001 kg
Steel	● (orange)	Virgin stream	100	0.0287 kg
Other metals, organics and plastics	● (orange)	Recycled content	50	0.0039 kg

- ● (green) Material has been assessed by an independent third party, based on supplier declaration and evidence from supplier
- ● (yellow) Material is free of C2C Banned list substances above accepted thresholds based on supplier declaration
- ● (orange) Material is free of REACH banned list substances above accepted thresholds based on supplier declaration[1]
- ● (red) Material contains C2C Banned list substances, or substances on REACH-list above accepted thresholds
- ? (red) Material safety unknown, based on supplier statement or absence of supplier declaration

[1] All materials used by Fairphone in the Fairphone 3 are free of REACH banned list substances above accepted thresholds based on supplier declaration. It is expected that the majority of materials used are free of C2C Banned list substances as well. However, this is still under investigation.

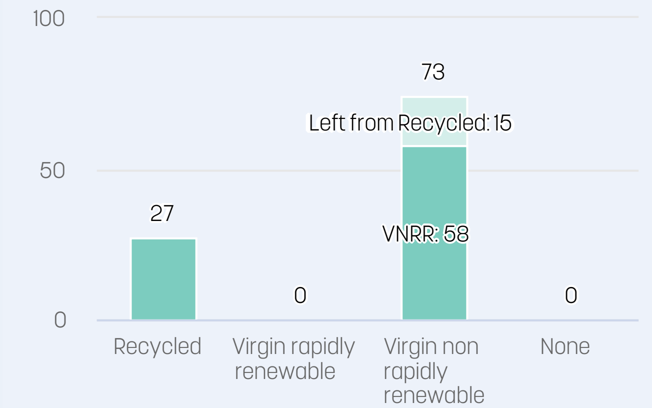
SUPPLIER STATEMENT

"It is our aim to move towards an economy that operates fully circular, where materials only stem from recycled sources. However we are also realistic that this transition will take decades, if not more. In the meantime, mining remains a key source of supply for many materials and is a key sector for many developing countries. Therefore, ensuring responsible mining where this is still a reality is key. Based on a defined material roadmap, Fairphone focusses on increasingly using responsibly mined materials next to increasing usage of recycled materials, thereby aiming to facilitate a fair transition to a circular economy. As circularity can be misused to look away from tackling issues related to virgin material production, we strongly recommend to include the category of 'Fair Virgin' materials in the product circularity report."

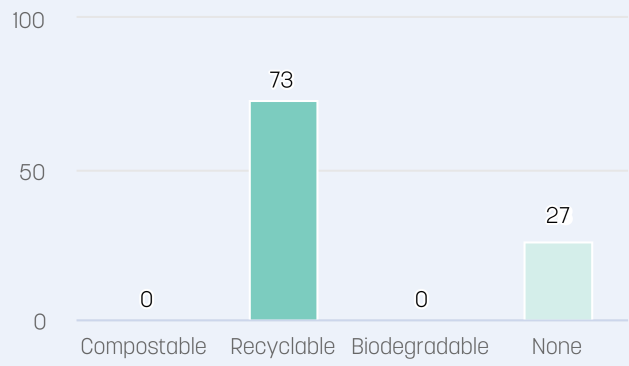
Disclaimer by Fairphone: "To enable conclusive comparisons between smartphones, Fairphone suggests the development of product circularity reports tailored to the assessed product category. This entails for example data input taking into account the granularity necessary to allow for detecting similarities and differences between different models. A differentiated approach moreover seizes the opportunity to focus on the larger issues affiliated with the respective industry and pointing out the most impactful solutions. "

CIRCULARITY CHARACTERISTICS

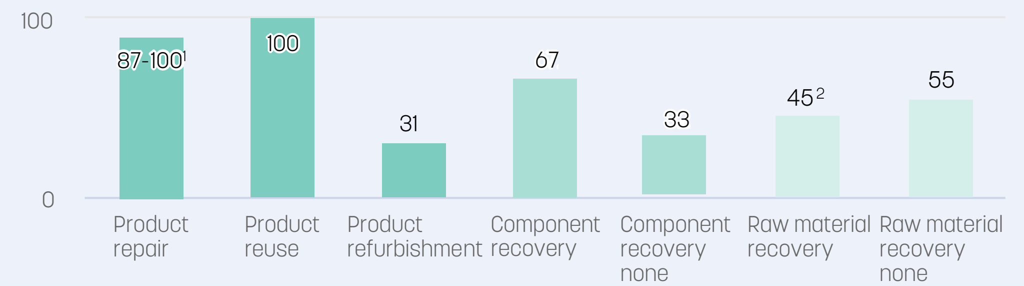
Material Composition - Input



Material Composition - Output



Product circularity



Residual value

€125.00

per product, after 3 years[3]

- The graphs as presented above give insight in the circularity of the product, its underlying components and materials
- The % product repair, reuse and refurbishment is calculated based on several variables, such as weight and answers to some specific questions
- The % Component Recovery is calculated via questions regarding easy disassembly and take-back scheme availability

More detailed explanation can be found in the explainer document. (click here to open)

[1] Product repairability calculation deviates from usual methodology, because this is less suited to reflect the reality of material recovery in the context of a smartphone. On smarphone specific repairability, the Fairphone 3 scores 10/10 on iFixit and 8.7/10 on the French government repairability index for smartphones.

[2] Raw material recovery calculation deviates from usual methodology, because this is less suited to reflect the reality of material recovery in the context of a smartphone. The raw material recovery value in this report is based on a study that is currently being executed at a third party, specific to this product. Find a link to the study here.

[3] Residual value estimated to be €100-€150 by Fairphone, no actual data can be provided due to the launch of the phone 1.5 years before the publication time of this report

CIRCULAR IQ

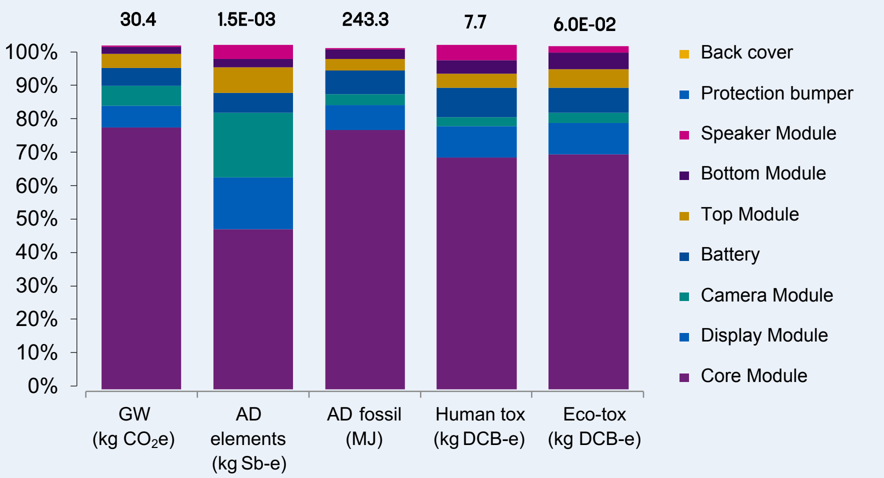
ECO-IMPACT

Fairphone 3

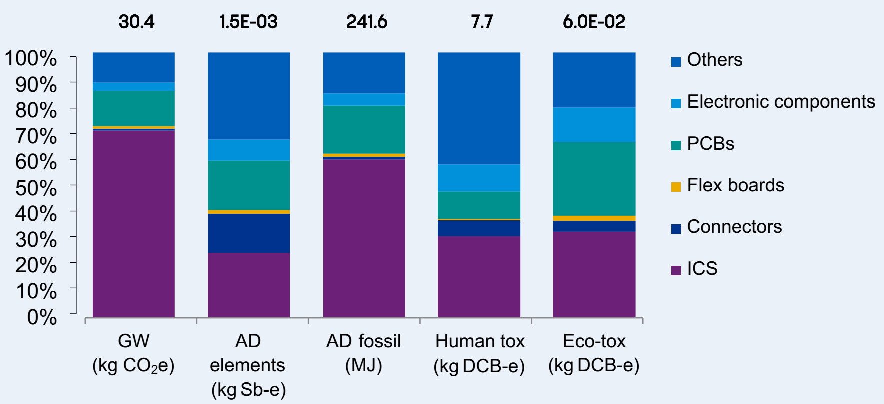
KPMG

External impacts of production for the Fairphone 3 include an impact on global warming of 30.4 kg CO_2e per unit, with the highest impacts for the Integrated Circuit Board in the Core Module

Breakdown of production impacts[1] of one Fairphone in parts (3-year scenario)



Breakdown of production impacts[1] of one Fairphone in component types (3-year scenario)



[1] Both breakdowns are without packaging, assembly, and screwdriver

External impacts[2] of production of As-Is situation Fairphone 3:

The materials and components used to produce the Fairphone 3 each cause a different size of impact on the environment and human health within their production supply chain.

These external effects have been quantified within the dimensions global warming, abiotic depletion of elements and fossil resources, human toxicity and eco-toxicity. The relative contribution of the components to these stressors are shown in the graphs on the left, along with the absolute impacts.

+ The core module causes the highest impact in each of the categories
+ In terms of component types, the integrated circuit boards present in the core module account for a large share of the impacts, especially for global warming and fossil depletion.
+ The PCBs also contribute significantly to all impacts.
+ The relatively high impact of connectors in element depletion is due to the use of gold.[1]

[2] Source: Proske, M., Sánchez, D., Clemm, C., & Baur, S. (2020). Life cycle assessment of the Fairphone 3. - The functional unit of the LCA is intensive smartphone use over three years. The corresponding reference flow is the Fairphone 3 as delivered to the customer, without charger. In this document, also excluded are the packaging, screwdriver and assembly.

GW (Global warming): climate change due to the emission of greenhouse gases, measured in CO_2e.

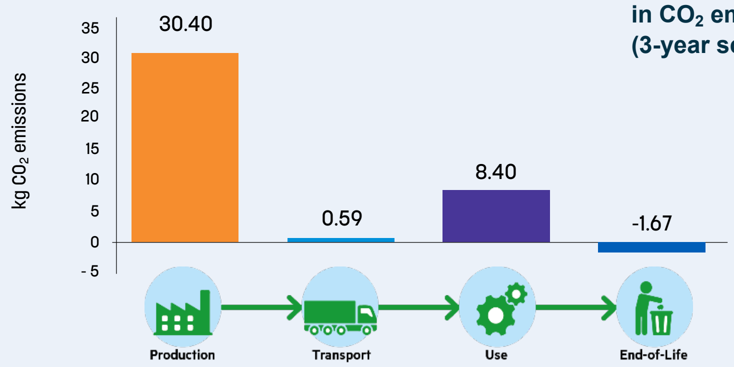
AD (Abiotic resource depletion):
+ elements: depletion of natural non-fossil resources, measured in antimony equivalents (kg Sb-e).
+ fossil: depletion of natural fossil fuel resources, measured in MJ.

Toxicity: impact on humans (human tox) or other organisms (eco-tox) of toxic substances emitted to the environment, measured in dichlorobenzene equivalents (kg DCB-e).

Value chain analysis

+ The production phase generates the bulk of the CO_2 emissions over the life cycle.
+ The use phase, associated with consumption of electricity, constitutes the second largest impact. A 3-year scenario is used here; due to the high production impact a longer lifetime will result in a lower impact on a yearly basis.
+ Although materials need to be transported a long way (China), the emissions are negligible compared to those of production and use.
+ At end-of-life, all materials will be treated in open-loop recycling, resulting in net avoided emissions through precious metal recovery.

Value chain impact in CO_2 emissions (3-year scenario)



OPPORTUNITIES

Fairphone 3

By focusing efforts on lifetime extension and recycled content, the carbon footprint can be reduced by ~31%

Key opportunities to lower CO_2e impact explored

The carbon footprint of each Fairphone could be reduced from 30.4 to 21 kg CO_2e per unit by extending the product lifetime and increasing recycled content. Annually, this could save 9,400 kg CO_2e[1].

[1] based on illustrative number of 1,000 Fairphones procured

1 Increasing lifetime from 3 to 5 years

The bulk of the impacts of the Fairphone are found in the production phase. By extending the lifetime of the phone, the impacts of production and transport are reduced. Fairphone actively strives to do so. Here we show the potential reduction in CO_2e of increasing the lifetime from an illustrative 3 to 5 years. Additional impacts from battery replacements and repair were included (Fraunhofer[2], tables 4-7 and 8-3).

Supplier response

Fairphone aims at supporting Fairphone 3 for 5 years among others with respective repairable design, spare part management, software support as well as software and hardware upgrades e.g. the camera module. As the phone has been released in September 2019, we cannot measure yet if our customers keep their phone indeed for this timespan. However, we have started to monitor metrics to determine if we are on track to reach this goal.

[2] Source: Proske, M., Sánchez, D., Clemm, C., & Baur, S. (2020). Life cycle assessment of the Fairphone 3.

2 Using 50% recycled gold

Gold was defined by Fairphone as one of their focus materials. It is mainly present in the connectors, PCB, camera and speaker. While the phone contains just 0.143 grams[3] of gold, the primary production of the metal has a very high GWP impact and the electronics industry overall is, as a sector, the third largest buyer on the world market. The primary impact is around 18 ton CO_2e/kg, while that of secondary gold production is just about 0.5 ton CO_2e/kg. Assuming that the current recycled content is zero, the graph below shows the potential GWP reduction from increasing this to 50%.

Supplier response

Artisanal and small scale mining (ASM) of gold causes around 30% of global mercury emissions, thereby highly polluting environments and risking health and safety of mine workers, among which are children, and communities around ASM mines. Next to substantive challenges, ASM gold mining presents a tremendous opportunity to positively impact the livelihoods of millions of people. Therefore Fairphone is seeking continuous improvements by working with committed ASM sites on their social and environmental performance and business practices and consciously choosing to source Fairtrade Certified Gold.

[3] Contained in PCB and battery, therefore not explicit in material input list

3 Moving to 100% recycled PC

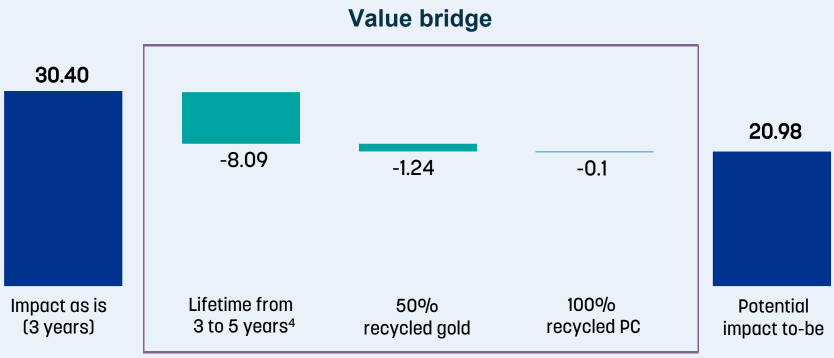
The plastic used for the module housing, midframe and back cover of the Fairphone are made of polycarbonate (PC). The recycled content of these material inputs varies from 0 to 75% and averages 40%. Recycled PC is estimated to have a 60% lower carbon footprint than virgin PC. The graph below shows that a move towards completely recycled PC, which is available on the market, has a limited positive effect on the carbon footprint of the phone.

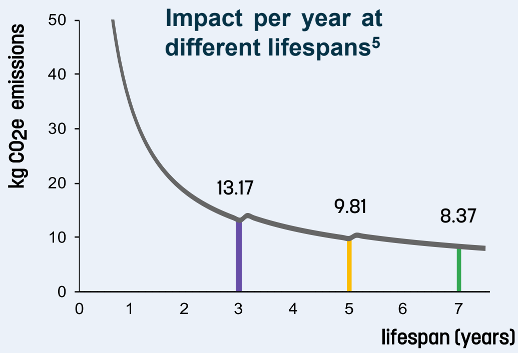
Supplier response

The plastic is contained in numerous small parts from many different suppliers often fulfilling functions which demand a mechanical strength that 100% recycled plastics cannot provide today. Fairphone therefore looks at possibilities to integrate recycled reinforcers into recycled plastics.

Potential Impact for To-Be design

These graphs represents the potential CO_2e impact with the given opportunities as displayed above.





[4] Accounting for the GWP of material production, transport and EoL, discounted for increased lifetime, plus the one time impact of battery replacement and repairs. See the graph on the right for insight into the full value chain impacts incl. use phase.

[5] This shows the relative decrease of the production-, transport- and eoL impact. The jumps can be explained by a battery replacement after 3 and 5 years.

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GLOSSARY

Circular Product Passport

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Terminology	Explanation
Biodegradable material	If the material is shown to degrade completely by bacteria, fungi, or other biological means in an industrial composting facility within a prescribed time frame. It means a material that can break down in the environment without causing harm.
Component recovery	The presence of a take-back scheme for the product and the technical possibility to separate the components from the product, without damaging them. For this to be possible, all connections above the component level will have to be accessible and reversible.
Compostable material	If suitable for organic recycling i.e. compostable in an industrial composting plant. In order for a product to be called 'compostable', it needs to biodegrade in a defined time, without harmful substances or Eco toxicity. These requirements are laid down in European standard EN 13432.
Designed for disassembly	If a product is easy to disassembly and if the connections are accessible. Easy to disassembly meaning that materials are easy separable from each other with the use of standardized tooling and/or disassembly can be done without the need for additional materials and/or without leaving contaminations or damages. Connection accessible meaning if one can easily access the point of connection between materials and components within a product without breaking or removing other parts.
Eco costs	Environmental impact of a product expressed in external costs (€) and based on the cost of prevention of such impact. Eco-costs are compiled by the dimensions eco-toxicity, human health, resource depletion and climate change and are quantified in this respect.
Circularity Score (CS)	Indicator score that provides insight in the level of circularity of the assessed product expressed as a percentage (%). This % is compiled of the inflow and outflow information on a material level as entered by the supplier via the tooling of Circular IQ. Inflow is the sum of % Recycled and % Virgin rapidly renewable content. Outflow is the sum of %Recyclable, % Compostable and % Biodegradable at end-of-life.
Material Safety	A traffic light color coding is used, to provide insight in the information that is available regarding the safety of the materials used. The exact meaning of green, yellow, orange, red and red with ? can be found on page 3 of this report.
Product refurbishment	The ability to renovate the product and give it the same properties as a new product would have, by doing work such as repairing, cleaning and updating firmware.
Product repair	Repairability starts with the ability to disassemble/open the product using common hand-tools, to access its parts and materials. Instructions for disassembly should be available on the product or a manual. Products should consist of standard and modular components. The availability of parts should be available through regular distribution channels and easy to re-assembly. Product repair in this report relates to the technical ability to repair and not to the fact if products are actually being repaired currently
Product reuse	The ability to reuse the product in whole at the end of the economical lifetime.
Rapidly Renewable	Material/content that is grown and harvested in cycles of less than 10 years. FSC certified wood and wood products may also be counted as rapidly renewable, even if they are grown and harvested in cycles of more than 10 years.
Raw material recovery	The presence of a take-back scheme and the ability to recover all materials used in the product without decreasing their properties, so they can be recycled on the same level. For this to be possible all connections above the material level, will have to be accessible and reversible (assuming disassembly is a prerequisite for raw material recovery).
Recyclable material	If it is technically possible to recycle them, retrieve them on their original or even higher quality and at least one commercial recycling facility exists.
Recycled content	Recycled material/ content that has been recovered or diverted from the solid waste stream, either during the manufacturing process (pre-consumer/post-industrial) or after consumer use (post-consumer)
Residual value	The residual value is defined as an estimated amount that a company can acquire when they dispose of a product, component, or material at the end of the expected economic lifetime/ use time.
Virgin material	New material/content that has been derived/produced after mining and/ or extracting resources.
Virgin non rapidly renewable	Virgin content/material that comes from finite/non-rapidly renewable sources