Foxway

Report

Giving new life to used tablets:

Estimating the positive impact of Foxway using the handprint approach

October 2021

Key terms and definitions

Carbon footprint	The total amount of greenhouse gas emissions (expressed in carbon dioxide equivalents) that are generated by an individual, event, organization, service, or product.
Carbon handprint	Beneficial environmental impacts that organizations can achieve and communicate by providing products that help their customer avoid carbon emissions.
CO_2-eq	Carbon dioxide equivalent is used to compare the emissions from various greenhouse gases on the basis of their global warming potential by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential.
EOL	End-of-life. In the context of product life-cycles, EOL is the final stage of a product's existence.
GHG	Greenhouse gas. The primary greenhouse gases in Earth's atmosphere are water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). Water vapor and ozone are not quantifiable with global warming potential (as they are short lived gases) and are not included in the carbon footprint calculations .
ICT	Information and communication technologies.
ISO	International Organization for Standardization is the world's largest developer of voluntary international standards and it facilitates world trade by providing common standards among nations.
LCA	Life-cycle assessment. A methodology to quantify and assess the inputs, outputs and potential environmental impacts of a product system throughout its life-cycle (ISO 14040; ISO 14067:2018).
WEE	Waste electrical and electronic equipment, i.e., e-waste.

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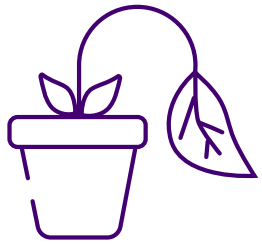
01. Background

Increasing amounts of e-waste coupled with low collection and recycling rates...

+ In 2019, approximately **53.6 million tons (Mt) of e-waste was generated globally** (which brings to an average of 7.3 kg per capita), fuelled by increasing consumption rates of electrical and electronic equipment, dropping price of ICT products, their short life cycles, and relatively few repair options. With an annual growth of almost 2 Mt since 2014, this waste stream is expected to exceed 74 Mt in 2030 (Forti et al., 2020).
+ At the same time, **only 17.4% of that waste was formally collected and recycled** – the fate of the rest is uncertain, but majority is probably mixed with other waste streams, like plastic and metal, and even if it is (partly) recycled, it is often done under inferior conditions.
+ Europe has the highest collection and recycling rate compared to other continents (42.5% in 2019), but nevertheless, **recycling activities are not keeping pace with the global growth of e-waste** (Forti et al., 2020).

WEEE is the fastest growing waste stream in the world. The amount of e-waste generated in 2019 equals the weight of almost 4,500 Eiffel towers.

...have led to negative environmental impacts, loss of valuable finite resources, and growing pressure on the planet



+ Repairing old devices, on the other hand, saves energy and finite resources that would otherwise be consumed in the manufacturing of new products, which carries considerable negative impacts on the environment.
+ Especially from a global warming point of view and **when talking about tablets, it never makes sense to replace an old device with a new one**, because not only will the manufacturing of a new device require new resources, but newer tablet generations are generally more energy consuming than the previous ones as the market is moving towards products with higher processing capacity (EEB, 2019).

Foxway's recommerce business helps to alleviate this issue by extending the total service life of ICT products

Foxway's asset recovery services give tablets a longer life – they buy used or damaged tablets and WEEE, screen, sort, and test them, perform a regulation-compliant full data wipe, and repair as much as possible. In fact, most devices can be redeemed and are then sold through a network of resellers, thus being gifted a second lifetime.

This potentially brings significant environmental benefits. Indeed, the **extension of the service life of ICT products has been identified as the key strategy to minimize the total environmental impact of ICT products** (Prakash et al., 2012, Bakker et al., 2014).

Fortunately, there's a market demand for sustainable products and services and at least European consumers are becoming more open to buying used electronics, especially as home offices and e-schooling have become more prominent (DW, 2020).

Foxway's ambition

The Foxway of doing things, sustainably

+ Foxway's ambition is to be the top company in Europe for sustainable IT services and recycling, leading the way with **circular solutions** that go beyond the industry's traditional linear consumption models.
+ Extending ICT products' service life undoubtedly brings environmental benefits, but Foxway hasn't so far quantified their exact impact. However, in order to build a stronger foundation for their sustainability efforts (as well as for doing corresponding communication), calculating their positive impact on the environment is a necessary step.
+ In line with the above, the current study was set out to quantify the positive impact of refurbishing tablets.
+ Foxway's longer term goal is to cover all product lines that go through refurbishment processes (smartphones, tablets, etc) in a similar fashion so the company's asset recovery services total positive impact can be quantified on a yearly or quarterly basis.

Purpose of this study

Is to estimate the climate impact and advantage (compared to buying a new device) of a typical* Foxway's refurbished tablet

+ For this reason, a **partial life cycle assessment** (LCA) was conducted to quantify the GHG avoidance of refurbishing tablets, following the **Carbon Handprint methodology** (see next page for more details.

** By typical we mean an average refurbishment scenario for a Foxway tablet. For this, the climate impact of all the different refurbishment scenarios was evaluated and an average scenario was then calculated by using weighted average mean.*

Estimating Foxway's positive impact using the Carbon Handprint methodology

+ In contrast to *carbon footprint*, which refers to the *negative* environmental impact throughout the life cycle of a product, the term *handprint* refers to the *positive* environmental impact of a product throughout its life cycle.
+ The purpose of carbon handprint assessment is to calculate the beneficial greenhouse gas impacts of a product compared to an alternative solution (i.e., the baseline solution).
+ This fits well with Foxway's goal of being an ESG enabler since Foxway's asset recovery services help Foxway's clients improve their sustainability performance by avoiding unnecessary carbon emissions. Therefore, the handprint methodology allows Foxway to clearly communicate the climate benefits of their products and services.

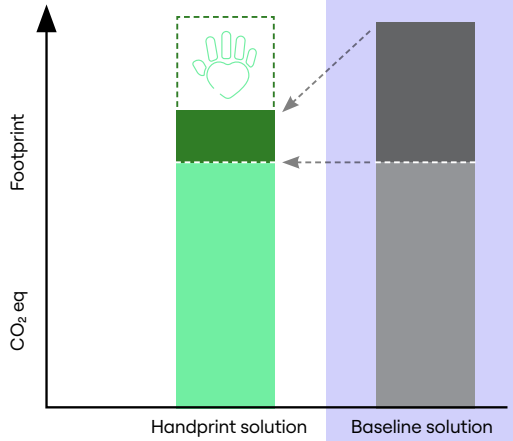


Figure 1. Example: handprint solution has a lower total CO_2-eq footprint compared to baseline solution.

Source: Pajula et al., 2018. Carbon Handprint Guide.

Handprint calculation itself is a simple equation that is based on carbon footprint calculations following **ISO 14040-44** and **ISO 14067** standards, which specify principles, requirements and guidelines for life cycle assessments (see next page for more details).

$$\text{Carbon handprint}_{\text{product}} = \text{Carbon footprint}_{\text{Baseline solution}} - \text{Carbon footprint}_{\text{Handprint solution}}$$

Where:
Baseline solution = production of a new tablet and its transport to customer
Handprint solution = refurbishing an old tablet and its transport to customer (aka the „Foxway solution")

Foxway's Handprint is based on a partial life-cycle assessment

+ Life-cycle assessment is a quantitative analysis of the environmental aspects of a product over its entire life cycle, from raw material extraction (cradle) to end-of-life (grave). Accordingly, a full life-cycle assessment is called cradle-to-grave.
+ For estimating Foxway's positive handprint, a **partial life-cycle assessment** was conducted to determine the climate impact of refurbished tablets. Specifically, processes **from raw material extraction until (and including) distribution to customers** were considered, leaving out the climate impact of the use phase and end-of-life stage.
+ This is in line with the ISO standards* for life-cycle assessment, which allow excluding phases that are considered to be equivalent when comparing the life-cycle impact of two (or more) alternative solutions. In other words, since the use phase and disposal/recycling for baseline solution and Foxway solution can be assumed to have equal climate impact, including them in the calculation would not influence the final outcome of the handprint calculation.

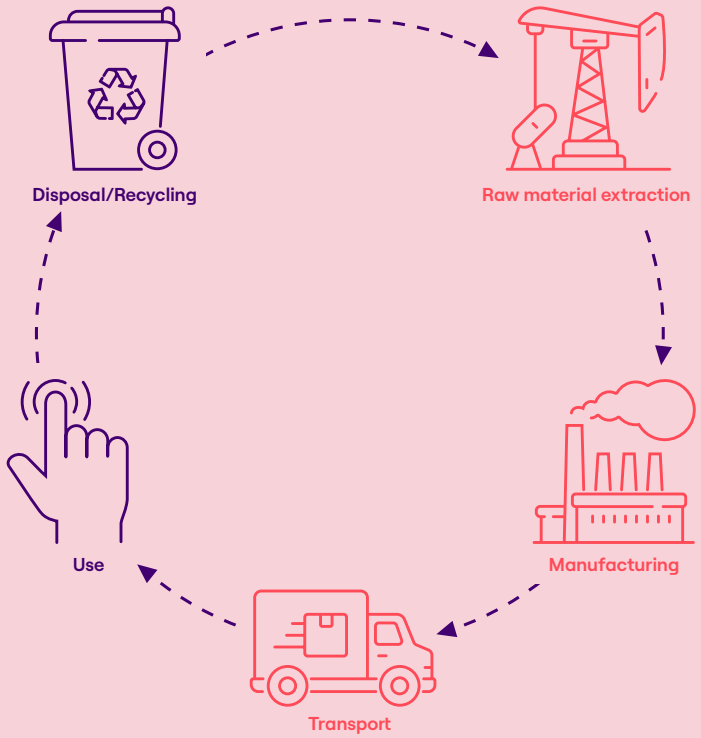


Figure 2. Product's life-cycle. Phases included in the calculations of the current study are depicted in red.

** ISO 14044 and ISO 14067. The former specifies requirements and provides guidelines for life cycle assessment, whereas ISO 14067 specifies principles, requirements and guidelines for the quantification and reporting of the carbon footprint of a product in a manner consistent with ISO 14044.*

02. Methodology

Identification of the operating environment

Carbon handprint is always quantified for a specific situation and a specific type of user.

The selection of the functional unit and system boundary must be consistent with the goal of the study and equal in baseline and handprint solutions

+ The buyers of a refurbished tablet are environmentally aware consumers or companies that value sustainability and are concerned about the environmental impact of their purchasing decisions.
+ Carbon emissions reduction in this study comes from the decrease in energy and resource demand which would have been needed to manufacture and transport a new tablet.
+ Baseline is an alternative solution to buying a refurbished tablet. Defining the baseline is necessary to compare the handprint solution to business as usual, i.e., "common" practice. Current baseline description: customer buys a brand-new tablet.
+ The functional unit for this study is: one tablet with expected use phase of 3 years.
+ A cradle-to-gate (incl. emissions until the point of sale) LCA was done for this study – life stages starting from (re) manufacturing and ending with transport to the customer. Considering the assumed functional equivalence of tablets in both scenarios, the use phase, transport to EOL, and EOL processing are considered identical in both solutions and thus can be left out of the equation as they do not affect the comparison.
+ Data to calculate carbon footprint of the handprint solution was gathered from Foxway (such as energy and heat use, tablets' and repair parts' import and export information, handled devices and parts' amounts). In addition, some information was obtained from different web-based databases (such as distance values, Estonian electricity mix). Impact assessment data was obtained from the Ecoinvent v3.7.1 database, various electronics companies' products' environmental reports and declarations and from relevant scientific literature.
+ Secondary data for the baseline solution was gathered from various product environmental reports and declarations published online.

System boundaries of the life-cycle assessment

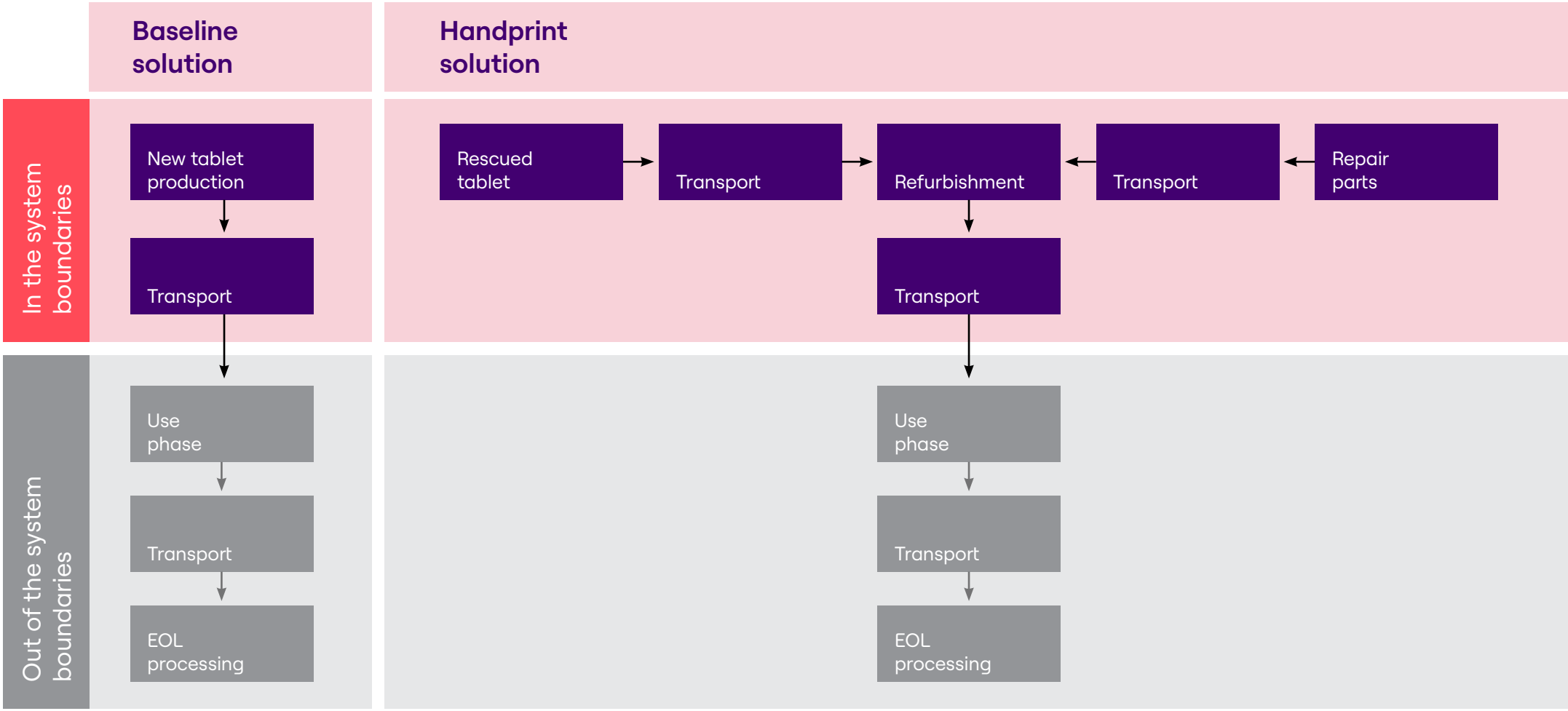


Figure 3. Life-cycle system boundary

Description of the processes that contribute to the footprint calculations

Refurbishment scenario of the handprint solution

Tablet import

Foxway imports used tablet mostly via economy delivery (99%), where a tablet travels on average 521 km on land and 374 km on water. The starting point is generalized to the country capital (e.g if tablet s are imported from Sweden, the distance is measured between Stockholm and Foxway 's main building in Tartu, Estonia, on Killustiku street)).

Product repair

There are two scenarios for refurbishment: repairs with parts (23 %) and repairs without parts, such are minor and data repairs (77 %).

Average carbon emissions emanating from the transport of one brand new spare part was calculated by analyzing different transport types (land, air, water), distance (km) and their occurrences (%) data was provided by Foxway . As a result, one brand new part travels on average 5697 km by air an d 268 km on land. These were quantified with the average part weight 6 grams) and with the corresponding emission factors from Ecoinvent v3.7.1 database. The average brand new part weighs only 6 grams due to the fact that 96,8% of the time the repair is done only with an adhesive tape. If to take into account all the repairs done with both brand new and reused parts, then the usage of the adhesive tape in repairs drops down to 55%.

To calculate the transport emissions of reused parts, tablet import data was used, as reused parts come for the tablets that are not repairable. The values were quantified with the average reused part weight of 147 grams.

Energy demand

In addition to greenhouse gas emissions from spare parts' production and their transport, Foxway's buildings heat and electricity demand was also accounted for. Total demand was calculated per device to estimate the energy need of the refurbishment process .

Description of the processes that contribute to the footprint calculations (cont.)

Tablet export

Once the tablets are refurbished, they are exported 62% of the times via economy delivery (where a tablet on average travels 1883 km on land and 159 km on water) and 38% via express delivery, where on average 4638 km is covered in air and 183 km on land. Again, the destination is generalized to the country 's capital.

Baseline scenario

The refurbished tablets are mainly divided into two manufacturers, Apple (67%) and Samsung (32%), leaving only 1% to be consisted of various other brands. Samsung has not made any of their products' environmental declarations publicly available, so the baseline scenario had to be ba sed solely on Apple iPads' environmental declarations (4 reports of the models released in 2020).

During the research, it was evident that the carbon footprint of an electronic device also depends on the storage capacity, the results ranging from 140 kg CO 2 eq with 128 GB to 227 kg CO 2 eq with 512 GB storage for just one model*.

In order to find the ultimate average carbon footprint, data was assessed based on the storage capacities that Foxway refurbishes and puts into recommerce . The results were:

16 GB - 41 %
32 GB - 24 %
54 GB - 10 %
128 GB - 5 %
256 GB- 1 %
512 GB - 0,1 %
N/A- 18 %

This distribution was used as a basis to calculate the weighted average mean of a tablet carbon footprint, with N/A distributed proportionally between different storage capacities.

As there is no information on 16 GB tablet carbon footprint, the same values were implemented as for 32 GB.

*iPad Pro Product Environmental Report

Important presumptions behind the calculation

1. The rescued tablet is considered waste, because:

+ Nearly all tablets that Foxway handles are at least 3 years old (94% are 3 years or older), and since 3 years is considered an average useful lifetime of a tablet (based on scientific articles and reports*), the assumption has been made to regard the used tablets as saved from disposal.
+ During the refurbishment, the tablet's performance is enhanced to extend its lifespan. Without the refurbishment, the tablet would most probably be disposed after first use.

2. The refurbished tablet is assumed to be functionally approximately equivalent to a new tablet and is assumed

3. The use and EOL phases of the baseline and handprint solutions are considered to be equivalent.

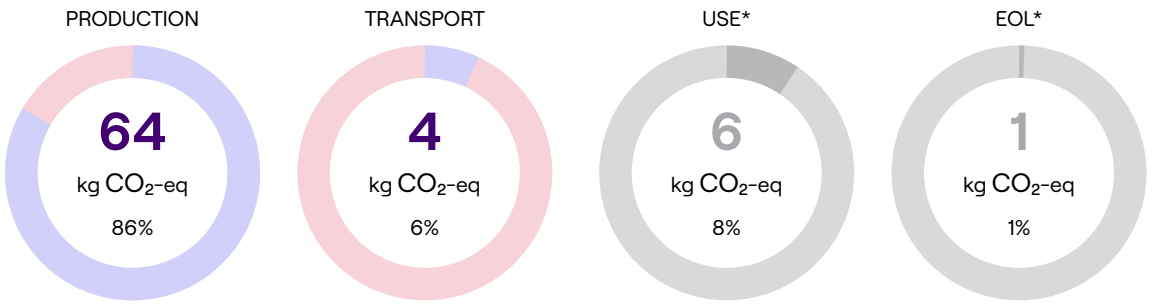
** Thiébaud (-Müller) et al., 2017; EP, 2016; Apple iPad Product Declarations*

03. Results

Baseline solution's climate impact:

Production of a new tablet and transport to consumer causes ...

+ Carbon footprint (kg CO2-eq) of the baseline solution is based on 4 Apple iPad models released in 2020. Data was obtained from respective environmental reports.
+ **An average carbon footprint of a new tablet is 75 kg CO2-eq**, as the calculation was heavily impacted by the results of a tablet with smaller storage capability (around 80% of the baseline calculation consisted of a 32 GB storage model).
+ The main source of greenhouse gases is the tablet production, as around 86% of the impact derives from this stage. The use phase constitutes on an average 8%, transport to user 6% and EoL 1%.
+ Since use phase and EOL are not included in the system boundaries, **baseline carbon footprint equals: 64 kg CO2-eq + 4 kg CO2-eq = 68 kg CO2-eq**



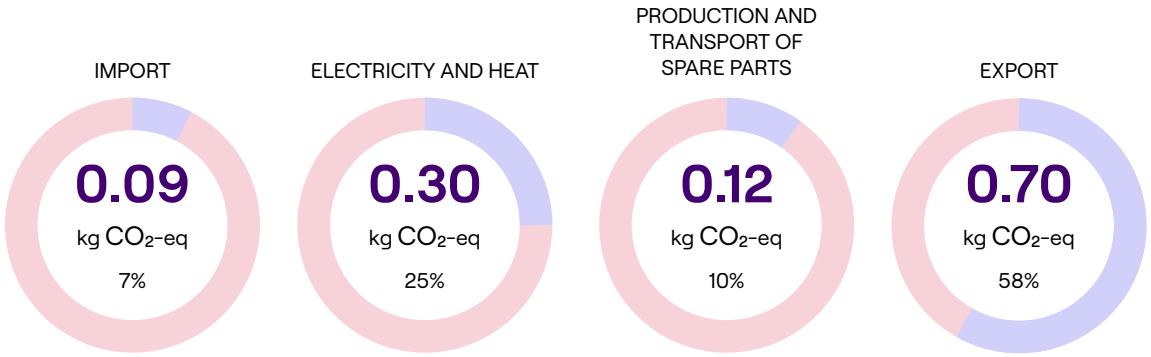
** Use and EOL are out of the system boundaries of this study*

... 68 kg CO_2-eq emissions

Handprint solution's climate impact:

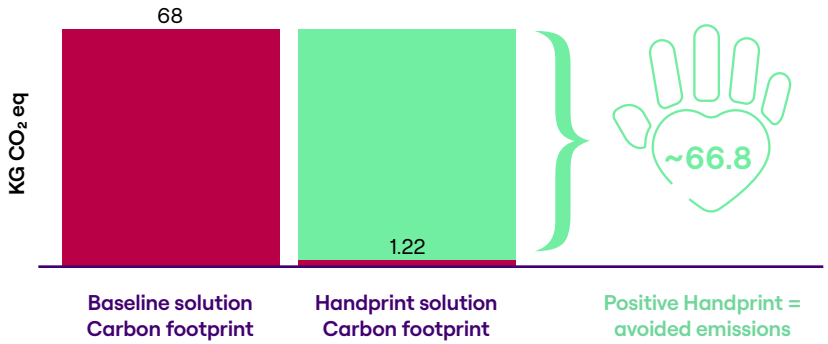
Refurbishment & transport of a Foxway tablet to the customer causes ...

+ Tablet transport to Foxway (import) emits on average **0.09 kg CO2-eq**, energy input to refurbishment processes (electricity and heat use in the factory) **0.30 kg CO2-eq**, spare parts production and transport to Foxway only(!) **0.12 kg CO2-eq** and refurbished tablet's transport to customer (export) emits **0.70 kg CO2-eq**.
+ All these add up to a total climate impact of **1.22 kg CO2-eq**.
+ Considering that the used tablet is handled as waste, it carries no production legacy. The impact of the production of spare parts is very low due to the large quantity of reused parts (salvaged from old tablets) which also carry no production legacy. Also, brand new parts do not hold a large carbon footprint as it consist mainly of adhesive tape (97%).
+ Import value is lower than export value, because mainly economy delivery is used for import (99%), whereas express delivery is used 38% of the times for exporting tablets.



... 1.22 kg CO_2-eq emissions

The Carbon Handprint of one refurbished tablet is 66.8 kg CO_2-eq



In other words, by buying a refurbished tablet from Foxway instead of purchasing a brand new tablet, a customer will avoid ca 67 kg CO_2-eq worth of emissions.

$$\text{Carbon handprint}_{\text{product}} = \text{Carbon footprint}_{\text{Baseline solution}} - \text{Carbon footprint}_{\text{Handprint solution}}$$

$$68 \text{ kg } CO_2\text{-eq} - 1.22 \text{ kg } CO_2\text{-eq} = 66.8 \text{ kg } CO_2\text{-eq}$$

04. References

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