CTOUCH RIVA CIRCULARITY PASSPORT

CO₂ FOOTPRINT & MATERIAL REPORT

In co-operation with
Technical University Eindhoven
Dispersed

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PREFACE

As a designer and manufacturer of touchscreen solutions for education and corporate businesses, we often receive questions about sustainability in relation to our products. Most of those questions are related to the recycling of product packaging and the usage of raw materials. Although these topics are important in the industry's mission to limit excessive usage of (scarce) resources, we believe sustainability is much more than recycling. The environmental footprint and circularity of the consumer electronics that make our lives so much better should become a key topic on the agenda of AV industry pioneers.

CTOUCH, in cooperation with Dispersed and the Eindhoven University of Technology (TU/e), has conducted independent research on the CO_2 impact of the manufacturing and use of interactive flat panel displays (IFPD). This research gives many new insights and has led us to initiate several new, innovative projects that benefit the environment, as well as schools, universities and companies that are planning to invest in new technology. A true win-win concept, of which CTOUCH is very proud.

The first initiative is CTOUCH' Circularity Passport, which you are reading right now. This passport gives a transparent insight into CO_2 impact and material usage, which enables us to create awareness about the CO_2 impact of touchscreens. It also triggers dialogs with CTOUCH partners about re-usage of these electronics, creating environmental and commercial benefits.

The second initiative is abovementioned re-usage mission brought into practice: CTOUCH 'BRIX'. This is a modular business model, using the touchscreen as a basic platform, which is upgradeable via modules and licenses. In a nutshell, this means companies will be able to upgrade or migrate to different collaboration solutions when their needs change, without having to completely replace their CTOUCH touchscreen. This saves time, money and encourages re-purposing technology.

Completing the 'CTOUCH Circle', we literally stand by one of our company values *We Own It*. We do this by offering companies to replace their CTOUCH touchscreens with a financial benefit on new CTOUCH technology, allowing us to repurpose their used touchscreens in other markets.

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CONTENT

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This document explains the CO_2-impact and material use for our touchscreen, the CTOUCH Riva. This life cycle analysis has been carried out according to the LCA-method (Life Cycle Analysis), taking the CO_2-emissions during production, transport, packaging, use and end of life into account. Based on these insights, recommendations are given and projects will be executed to improve our carbon footprint. This study shows that the production and use phase are related to the highest CO_2-emissions. In order to reduce this impact, the following actions are most relevant:

1. Optimization of the production process (better use of materials and energy)

2. Optimization of the energy use during lifetime

3. Extending the life-cycle of out touchscreens

4. An optimal recycling at the end-of-life phase

The greatest impact can be achieved in terms of energy use, a longer life cycle and an optimal recycling. Energy consumption can be improved by an energy-efficient design and by actively stimulating the end user to use our products as efficient as possible. The lifetime of our products can be prolonged through circular business models such as refurbishing, modularity and as-a-service models, where our BRIX platform is the main prerequisite. Recycling can be improved in two ways, namely by providing a better infrastructure together with partners such as WEEENL and WeCycle and by a better data-collection to gain insight into the location and end-of-life phase of our products.

An important step towards a sustainable and circular CTOUCH was taken in 2019, in which we already conducted an LCA for the CTOUCH Leddura and the CTOUCH Laser touchscreens. We took some valuable insights with us during the development of the CTOUCH Riva and the CTOUCH Canvas (Q4 2020) of which the modular BRIX platform is the most important result.

Beginning of 2020, we also performed an LCA for our newest screens, the Riva and the Canvas. Some of the key findings of the LCA will be published in a materials passport for the Riva that shows exactly which and how many materials are used. We are also working on a pilot in which we are researching a more energy-efficient use of the screens, together with primary schools and high schools. In addition, we are currently taking the first steps in circular business models by giving our screens a second life in an educational environment after serving their economic lifetime in a business-environment.

In the near future, we plan to be the first manufacturer of touchscreen screens to earn an acknowledged international environmental or eco-label. Furthermore, in cooperation with WEEENL, we will take even more responsibility in recycling, among other things by setting up a collection infrastructure that will be the precondition for circular business models. Another upcoming project is to develop a sustainable education module for primary and secondary schools. By all means, we want to continue and improve our LCAs and material passports by gaining more insight and data about the production process, material use, energy use and the recycling phase. Naturally, we will continue to share our most valuable insights and ideas to make the whole touchscreen-chain more sustainable.

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1.
INTRODUCTION

This report provides the CO_2-impact of the entire life cycle of the Riva by means of a Life Cycle Analysis , or LCA (according to ISO 14040). An LCA is the widely most used scientific method to map the ecological impact of products. The ecological impact of products can consist of many indicators, but this research focusses on the CO_2-emissions during the different phases of our product's life cycle. With this insight, we will minimize the ecological footprint of our touchscreens.

An LCA can be carried out in two ways: by means of LCA-software or by means of a scientific literature study. In view of CTOUCH's practical aim to make concrete improvements based on the LCA, it was decided to conduct the CO_2 impact assessment on the basis of scientific LCAs, described in detail in the literature. For each LCA, two factors are most important: the materials present in the screen and the ecological impact of these materials at each stage of the life cycle. This life cycle consists of 5 phases, as can be seen in the image below: production, packaging, transport, use-phase and end of life.

Production
Packaging
Transport
Use
End-of-life

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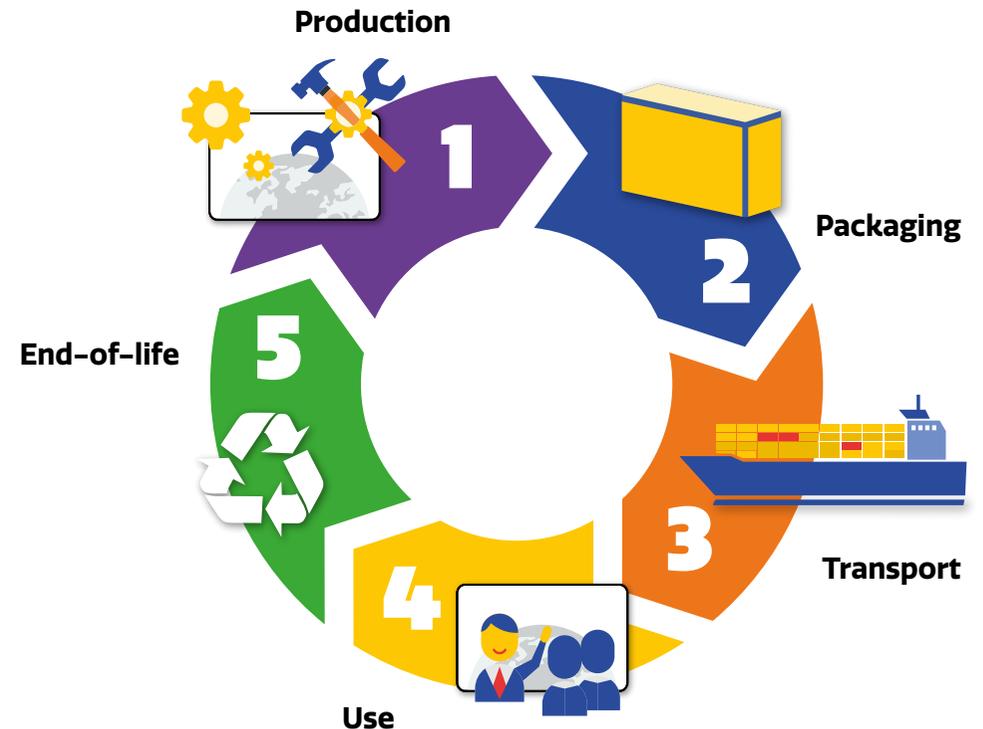
2.
INVENTARIZATION AND IMPACT ASSESSMENT

2.0   CO₂–impact analysis

This assessment was carried out on the basis of a thorough literature study that included all relevant scientific literature on LCD/LED displays and other consumer electronics. First of all, a general picture of the CO_2 emissions of various LCD screens, telephones, laptops and desktops was formed. From here, first a general, top-down estimate was made for the Riva. Next, a bottom-up approach was used to determine the CO_2 impact per gram of material for each part of the screen. In the end, these two estimates turned out to fairly accurately coincide with each other.

2.1   Production phase

General information

Bhakar, 2015 [1] shows that the printed wire board (PWB) has the highest impact during the production phase. Plastics, metal and glass have a very low contribution. The manufacturing phase dominates the lifetime CO_2–emissions for LED monitors with 70% of total carbon footprint.

This is because LED consumes less power, so the effect of use phase (30% of total carbon footprint) is relatively low [1]. Canetta et at., 2018 shows that consumer electronics like LCD monitors have a use phase impact of approximately 50% (LCD–monitor), 25% (smartphones) or 15% (tablet) of the total CO_2–footprint.

This means that for consumer electronics, the main impact in general lies in the production phase. Teehan [2] shows in figure 3.1 that earlier conducted LCAs towards desktop PCs in general show a production impact between 25-40% of the total impact. The rest of the CO_2–impact is almost fully due to the use–phase. Next, Teehan shows in figure 3.2 that the mainboard including internal circuits (ICs) in general contributes for 50–70% of the total production impact. Other components constitute small but non–negligible impact proportions [2]. The results of the LCAs found in literature vary strongly, mostly due to the assumptions regarding the impacts of the mainboard and ICs [2]. Teehan [2] further shows that the production phase impact of an Apple iPad (1st generation, 2009) exists for 50% of the IC's, mainboard and power supply and for 45% of the display. This also give an indication about the most important impact factors, namely the electronics and the display.

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Top-down analysis

According to the top-down approach, the production of an LCD monitor or LCD TV emits an average of 25-30 kg CO_2 per kilogram of product and the production of a desktop (ranging from 9-11 kg) emits approximately 13-23 kg per kilogram of product [2]. The production of an Apple Imac from 2019 costs about 37 kg CO_2 per kilogram of product [2]. According to Thomas et al., 2011 [3], the production of a 40-inch LCD TV emits 524 kg CO_2. According to Bhakar et al., the production of a 17-inch LCD TV with LED backlight is associated with about 95kg CO_2 [1].

In general, the CO_2 impact per kg of material decreases as displays are larger (as they contain relatively more material with a lower CO_2 impact, such as steel, aluminium and glass). In addition, the production impact of more recently produced displays is lower due to a more efficient use of energy during production and a more efficient use of material; based on these two insights and the values mentioned above, the production impact of the Riva is estimated to be between 10-15 kg per kg of product.

The above mentioned values provide the following top-down estimation for the Riva:

- 65 inch (46 kg): approximately 460-690 kg CO_2
- 75 inch (60 kg): approximately 600-900 kg CO_2
- 86 inch (73 kg): approximately 730-1095kg CO_2

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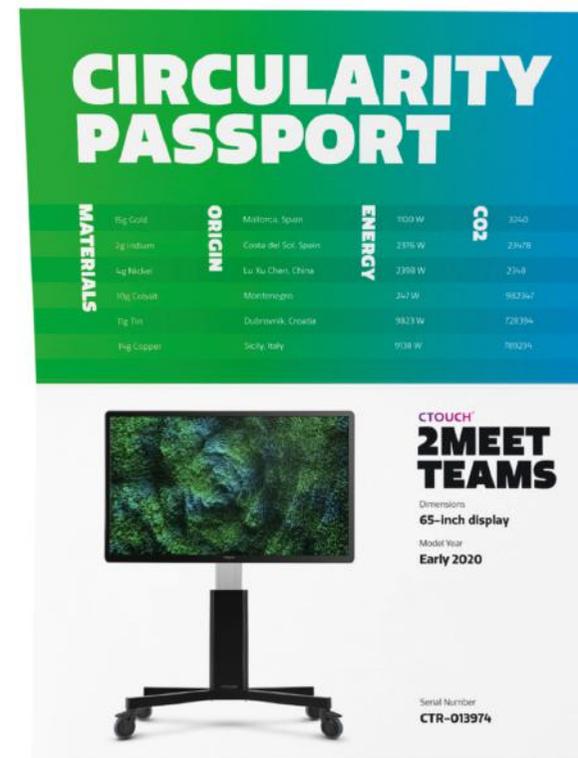CTOUCH®

Bottom-up analysis

On the basis of the literature study and the material passport, it appears that there are eight categories of materials that together make up the screen. These are steel, aluminium, glass, the mainboard (including ICs), the switchboards (including ICs), plastic, the power supply and the LCD panel. Literature shows that the LCD display, the PCBs, the ICs and the (possibly) rare earths such as gold have the greatest impact [1], [2], [3], [4], [5]. In the next section, for each abovementioned category, the CO_2-impact values are named and displayed in kg CO_2 emitted during the production of 1 kg of material (kg CO_2 / kg material). Based on these values, the impact values used in this LCA have been determined.

- According to Andrae et al.[4], stainless steel, iron and aluminium emit 6 grams, 6 grams and 12 grams of CO_2 per gram of material, respectively, during production. According to Sevenster et al. [6], steel and aluminium have a CO_2- impact of 1 gram and 5,5 grams of CO_2 per gram of material. Teehan [2] uses the value of 1,8 grams of CO_2 per gram of steel from the ecoinvent software. In our study, the values of 2 grams for steel and 6 grams for aluminium are used.

- According to Sevenster et al. [6] glass has an impact of 0,5kg CO_2 / kg glass. Andrae et al. uses 1g CO_2 / g glass. In our study, the value of 1g CO_2 / g glass is used, as in Andrae et al. [4] and close to the values mentioned in [6].

- The production of the mainboard (excluding ICs) equals about 65-70 g CO_2 / g [2, figure 3.3] or 90g CO_2 / g [5]. The mainboard including ICs equals about 160-370 g CO_2 emission during production [2]. Merve et al. [5] uses the value of 180 g CO_2 / g, Teehan et al. [2] the value of 180 g CO_2 / g and Apple uses 370 g CO_2. Our study uses the value of 370 g CO_2-emissions for the mainboards including ICs and 180 g for the switchboards including ICs.

- According to Andrae et al. [4], plastic (HDPE and PP) equals 2 g CO_2 emissions per gram of material. According to Sevenster et al [6], the general value for plastic of 3,5 g CO_2 / g material can be used. In this study, 2 g CO_2 / g is used, based on HDPE, as mentioned in [4].

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- The power supply is estimated by Teehan et al [2, figure 3.3] at 20g CO_2 / g material for a desktop PC. In addition, for a 21.5" LCD monitor, Teehan et al. shows that a value of 40 g CO_2 / g material can be used [2, figure 4.1]. In our study, a value of 40 g CO_2 / g will be used.

- Teehan [2] shows in Figure 4.1 that the display in an LCD-monitor causes about 80–85% of the total CO_2-impact in the production phase. For an iPad, the display accounts for approximately 40% of the CO_2-impact during production. Depending on the literature, the display is responsible for 53 g CO_2 per gram [2], 65 g CO_2 / g [2, figure 4.1, iPad], 55 g CO_2 / g [2, figure 4.1, LCD monitor 21.5"] or 40 g CO_2 / g [2, figure 4.1, LCD monitor 17"]. Apple uses 52 g CO_2 per gram display [2]. This study uses 50 g CO_2 / g.

- No values were found for the LED backlight. It is assumed that the production of the backlight goes accompanied with the same amount of CO_2 as the display itself, so 50 g CO_2 / g.

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MATERIALS	ORIGIN	ENERGY	CO2
11g Gold	Mallorca, Spain	1100 W	3240
2g Iridium	Costa del Sol, Spain	2376 W	23478
4g Nickel	Lu Yu Chen, China	2398 W	2340
10g Cobalt	Montenegro	347 W	982347
11g Tin	Dubrovnik, Croatia	9823 W	728394
14g Copper	Sicily, Italy	9738 W	789234

CTOUCH
2MEET TEAMS
Dimensions
65-inch display
Model Year
Early 2020
Serial Number
CTR-013974

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Results

In table 1, the materials as used in the Riva are presented. For each component, the amount in grams is shown. Then, in table 2, the CO_2–impact of each component is given in grams of CO_2 per gram material. For example, for steel, the production of each gram of material goes accompanied with 2 grams of CO_2. Furthermore, table 2 gives the total CO_2 impact values for each component. This is the amount of component present in the screen (in grams, given by table 1) multiplied by the CO_2–impact for each component (as given in table 2).

COMPONENT	GRAMS PER 65 INCH RIVA	GRAMS PER 75 INCH RIVA	GRAMS PER 86 INCH RIVA
Steel	6678	7515	8449
Aluminium	5735	6889	8020
Unidentified steel or aluminum parts	7500	12000	14000
Glass	12180g	16190g	21200g
Mainboard incl. IC's	439g	439g	439g
Switchboards incl. IC's	359g	359g	359g
Display	3800g	4880g	5900g
Power supply	907g	1384g	1384g
LED–backlight	512g	664g	929g
Packaging (zie par. 2.1.2)	7890g	9680g	12320g

COMPONENT	GRAMS OF CO2 PER GRAM MATERIAL	KG OF CO2 PER 65 INCH	KG OF CO2 PER 75 INCH	KG OF CO2 PER 86 INCH
Steel	2	14	15	17
Aluminium	6	34	41	48
Unidentified steel or aluminum parts	4	30	48	56
Glass	1	12	16	21
Mainboard incl. IC's	180–370	162	162	162
Switchboards incl. IC's	180	65	65	65
Display	50	152	195	236
Power supply	40	36	55	55
LED–backlight	50	26	33	48
Packaging (zie par. 2.1.2)		12	14	17
TOTAL		543	644	725

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CO_2-emissions for other products

To put these values in perspective, some general CO_2-emission values for different modes of travelling, different types of food and different forms of energy are included.

Electricity – 0,35 kg CO_2 per kWh:
the production of a 75 inch Riva corresponds to approximately 1850 kWh electricity [7].

Petrol car – 140 g CO_2 per kilometer:
the production of a 75 inch Riva corresponds to approximately 4600 km [8].

Cheese – 12 kg CO_2 per kg cheese:
the production of a 75 inch Riva corresponds \ to approximately 54 kg of cheese [9].

Chicken – 14 kg CO_2 per kg of chicken meat:
the production of a 75 inch Riva corresponds to approximately 46 kg of chicken [9].

Beef – 30 kg CO_2 per kg of beef:
the production of a 75 inch Riva corresponds to approximately 21 kg of beef [9].

Beer – 0,3 kg CO_2 per liter:
the production of a 75 inch Riva corresponds to approximately 2.150 liters of beer [10].

Soda – 0,5 kg CO_2 per liter:
the production of a 75 inch Riva corresponds to approximately 1300 liters of soda [10].

T-shirt – 12,5 kg CO_2 per T-shirt:
the production of a 75 inch Riva corresponds to approximately 52 T-shirts [11].

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2.2 Packaging

The packaging of the 65, 75 and 86 inch Riva consists of 1,59 kg, 1,94 kg and 2,13 kg of EPE and 6,3 kg, 7,740 kg and 10,19 kg of cardboard respectively. The CO_2 impact of EPE is 4,2 kg CO_2 / kg material and the CO_2 impact of cardboard is about 0,8 kg CO_2 / kg material [6]. This means that the CO_2 impact of the packaging is respectively 11.7, 14.3 and 17.1 kg CO_2 per screen.

2.3 Transport

Transport includes the transport of the finished product from the factory to the customer. According to Otten et al.[8], bulk transport by sea costs about 20 grams of CO_2 per tonne-kilometre. The CO_2-impact of land transport is about 10 times greater than the CO_2 impact of sea transport. With these values, the transport of the aforementioned 40-inch screen of 12 kg costs about 9,4 kg CO_2.

For an 86-inch screen from CTOUCH, the calculation is as follows:

- ⊘ First 12.000 km from China to Rotterdam by sea: 12.000 x (20 g/ tonne-kilometre) x 0,073 ton=17,5 kg

- ⊘ Then about 300 km by land, from port to customer: 300 x (200 g/ tonne-kilometre) x 0,073 ton=4,4 kg

SIZE AND WEIGHT	CO2-EMISSIONS DURING TRANSPORT [KG]
65 inch, 46 kg	14
75 inch, 60 kg	18
86 inch, 73 kg	21,9

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2.4 Use phase

The energy consumption during 7 years of usage has been determined by means of power measurements. Furthermore, three consumption scenarios have been drawn up to investigate the influence of different energy settings (normal mode, energy saving mode and a mix of 50% normal mode and 50% energy saving mode) on CO_2 emissions. It has been assumed that each screen is active for 1.460 hours per year (value also used by the 'energy label'). According to CE Delft [6], 1kWh in the current Dutch energy mix is associated with 355 grams of CO_2 emissions.

The measured values are as follows: **Power and energy consumption per touchscreen according to measurements**

TYPE	POWER [W]	YEARLY AMOUNT OF CO2–EMISSION (BASED ON 1460 HOURS OF USE PER YEAR) [KG]	CO2–EMISSION OVER ENTIRE LIFE CYCLE OF 7 YEARS [KG]
Riva: 65 inch, normal mode	160	83	580
Riva: 65 inch, energy saving mode	105	54	381
Riva: 65 inch, 50% normal/50% energy–saving	132,5	69	481
Riva: 75 inch, normal mode	295	153	1.070
Riva: 75 inch, energy saving mode	142	74	515
Riva: 75 inch, 50% normal/50% energy–saving mode	218,5	113	793
Riva: 86 inch, normal mode	360	187	1.306
Riva: 86 inch, energy saving mode	194	101	704
Riva: 86 inch, 50% normal/50% energy–saving	277	144	1.005

3.
RESULTS

Riva 65 inch

Material usage 65 inch
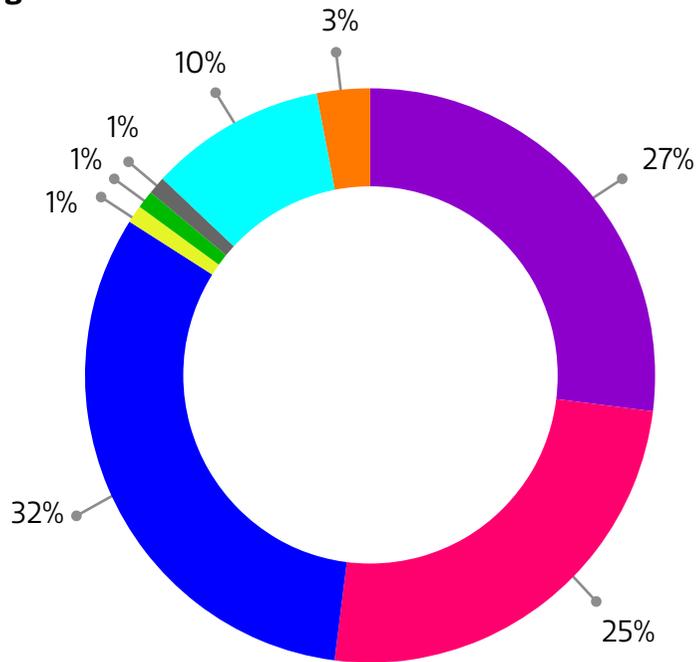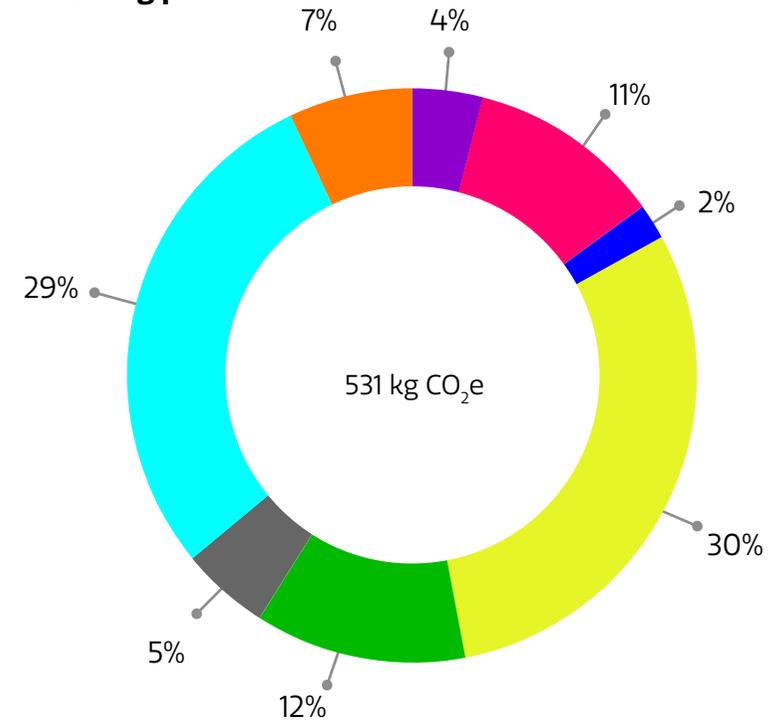
- 3%
- 10%
- 1%
- 1%
- 1%
- 27%
- 25%
- 32%

CO₂–footprint during production

- 7%
- 4%
- 11%
- 2%
- 29%
- 30%
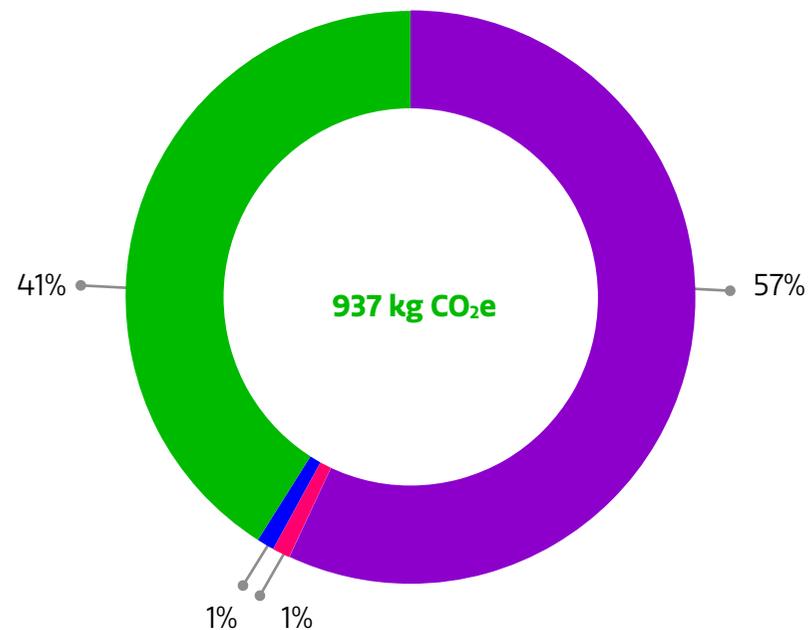- 5%
- 12%

531 kg CO_2e

■ Steel   ■ Aluminium   ■ Glass   ■ Mainboard including IC's   ■ Switchboards including IC's   ■ LED–backlight   ■ Display   ■ Power supply

Riva 65 inch

CO₂–footprint entire lifecycle (7 years) – energy use 100% normal mode
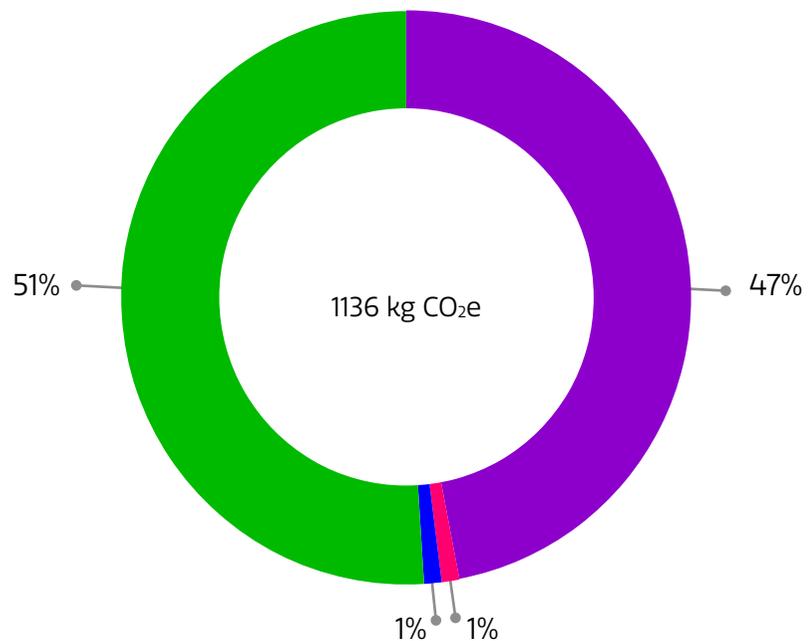
CO₂–footprint entire lifecycle (7 years) – energy use 100% energy saving mode

51%   47%

1136 kg CO₂e

1%   1%

41%   57%

937 kg CO₂e

1%   1%

Production   Packaging   Transport   Energy use

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Riva 65 inch

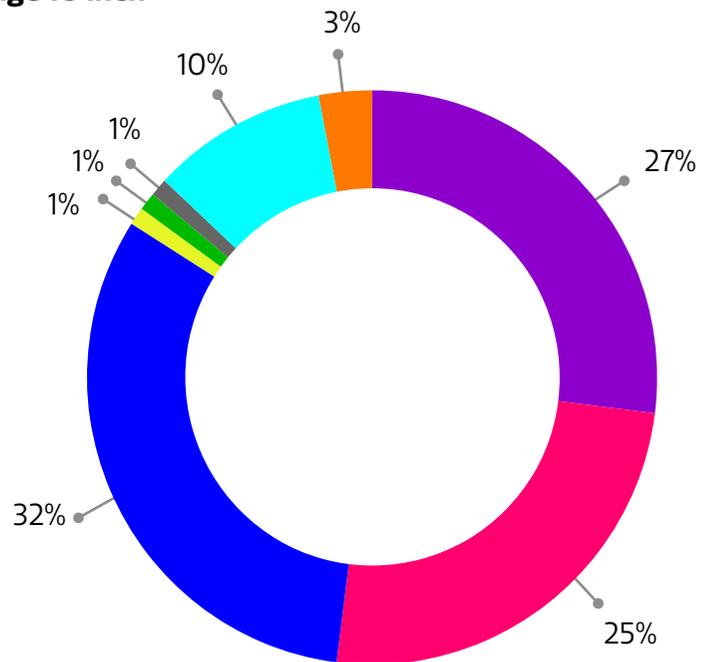**CO_2–footprint entire lifecycle (7 years) – energy use 50% energy saving mode/50% 'normal mode'**

47%

51%

1037 kg CO_2e

1%   1%
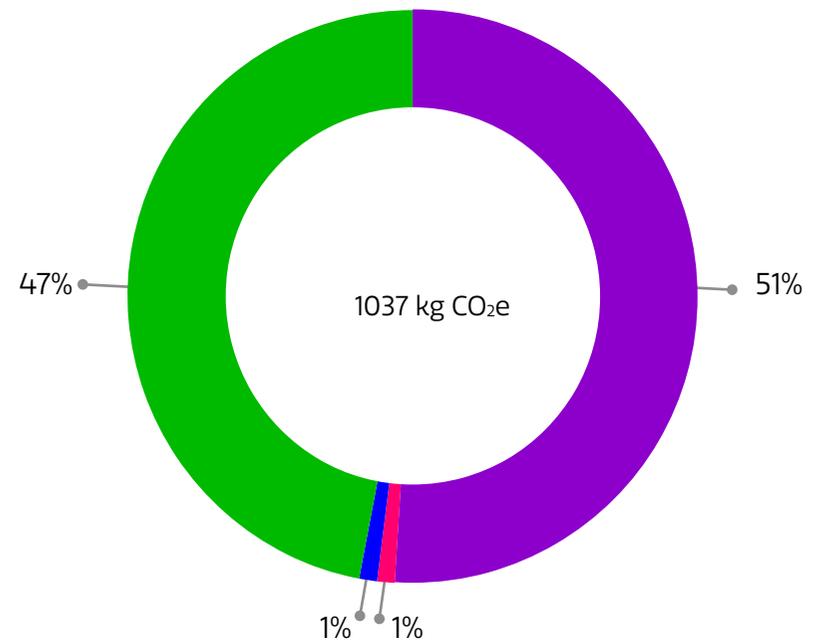
■ Production   ■ Packaging   ■ Transport   ■ Energy use

Riva 75 inch

Material usage 75 inch
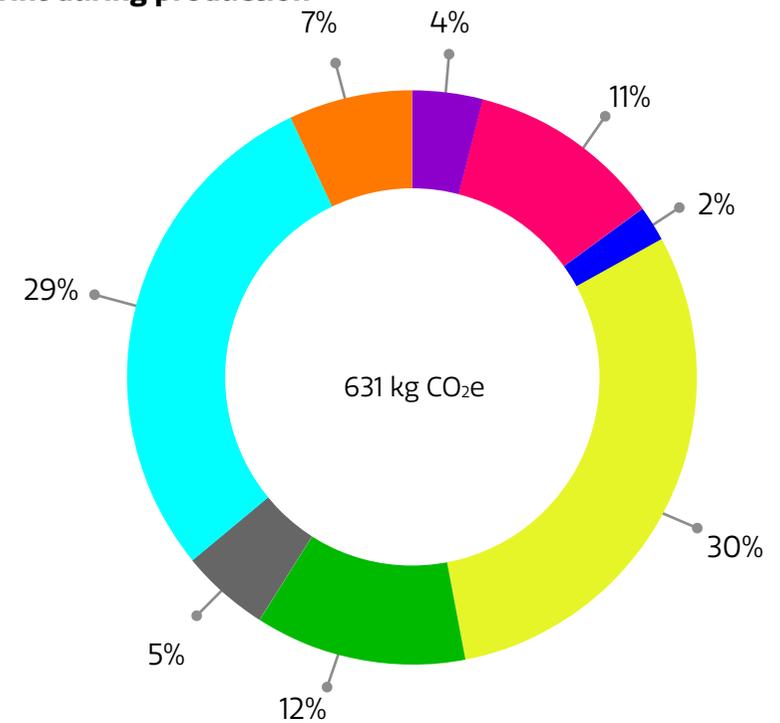
3%
10%
1%
1%
1%
27%
32%
25%

CO_2–footprint during production

7%
4%
11%
2%
29%
30%
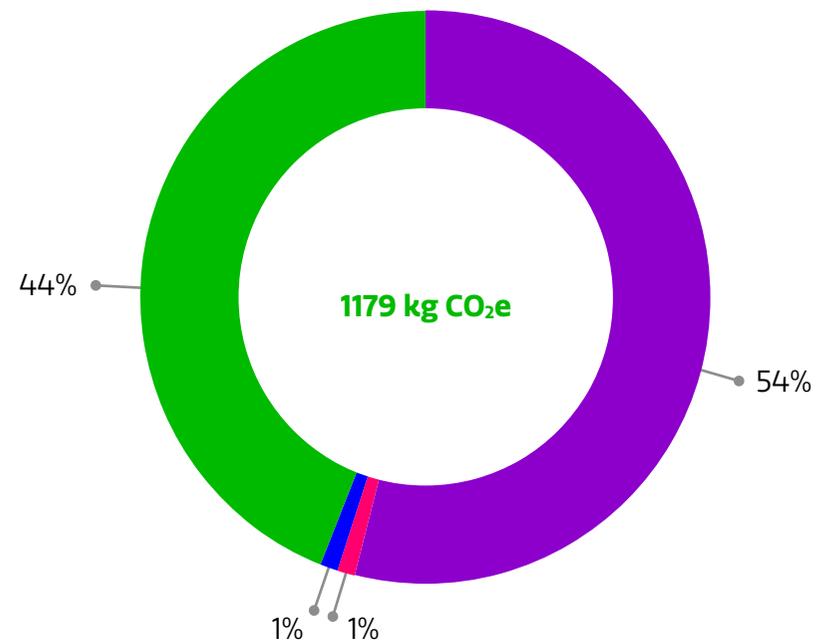631 kg CO_2e
5%
12%

■ Steel   ■ Aluminium   ■ Glass   ■ Mainboard including IC's   ■ Switchboards including IC's   ■ LED–backlight   ■ Display   ■ Power supply

Riva 75 inch

CO₂–footprint entire lifecycle (7 years) – energy use 100% normal mode

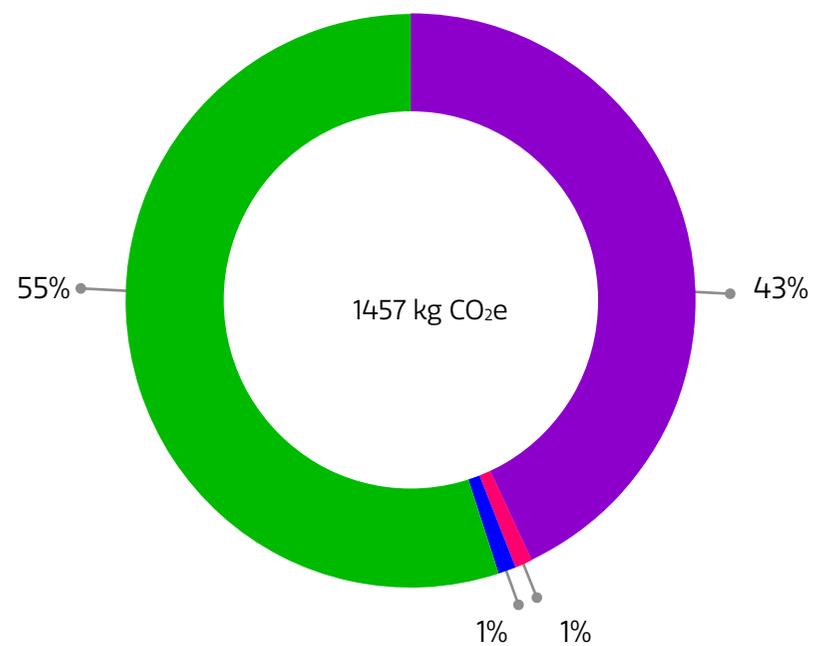**CO₂–footprint entire lifecycle (7 years) – energy use 100% energy saving mode**

1734 kg CO₂e — 36%, 62%, 1%, 1%

1179 kg CO₂e — 54%, 44%, 1%, 1%

Production　Packaging　Transport　Energy use

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Riva 75 inch

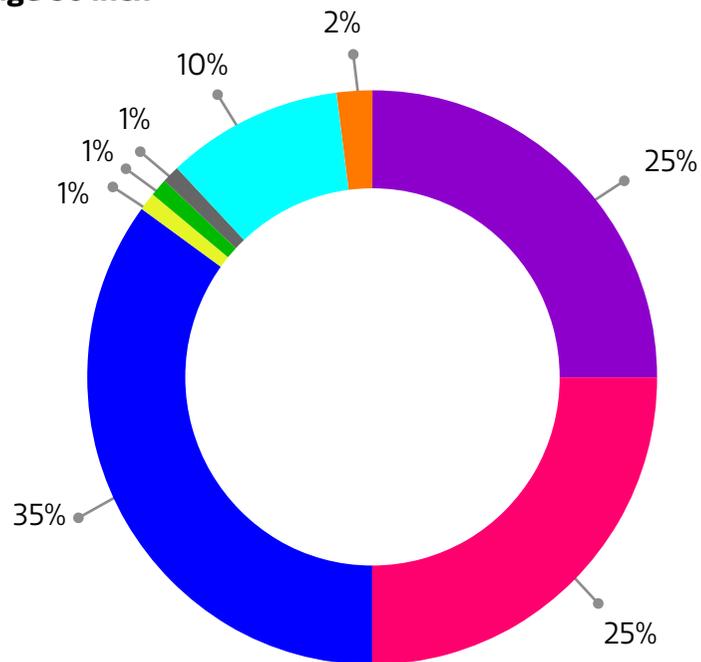**CO_2–footprint entire lifecycle (7 years) – energy use 50% energy saving mode/50% 'normal mode'**

55% • — Energy use

43% • — Production

1457 kg CO_2e

1% 1%

■ Production   ■ Packaging   ■ Transport   ■ Energy use

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Riva 86 inch

Material usage 86 inch
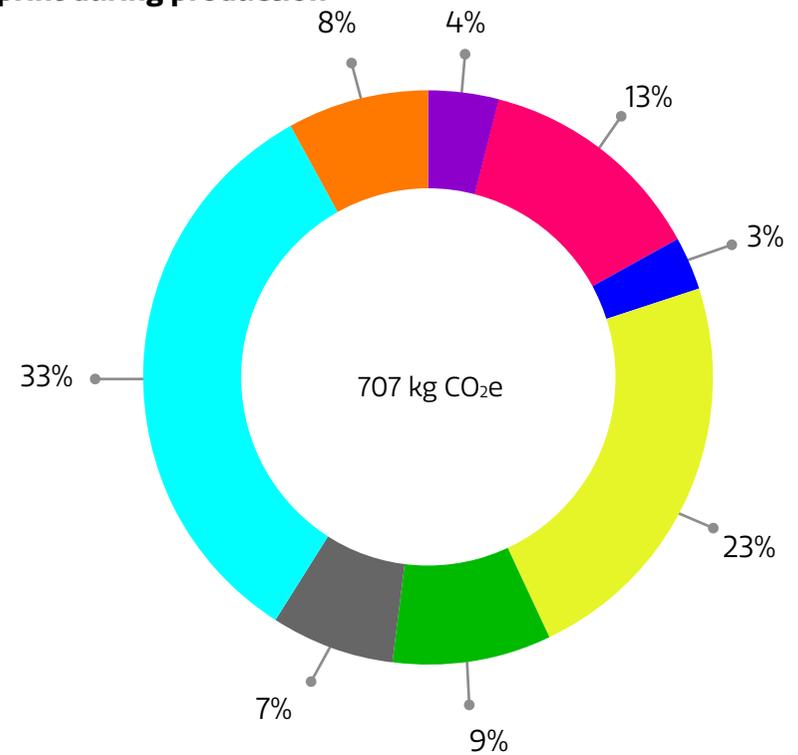
Steel 25%
Aluminium 25%
Glass 35%
Mainboard including IC's 1%
Switchboards including IC's 1%
LED-backlight 1%
Display 10%
Power supply 2%

CO₂–footprint during production

707 kg CO_2e

Steel 4%
Aluminium 13%
Glass 3%
Mainboard including IC's 23%
Switchboards including IC's 9%
LED-backlight 7%
Display 33%
Power supply 8%

Steel • Aluminium • Glass • Mainboard including IC's • Switchboards including IC's • LED-backlight • Display • Power supply

Riva 86 inch

CO$_2$–footprint entire lifecycle (7 years) – energy use 100% normal mode
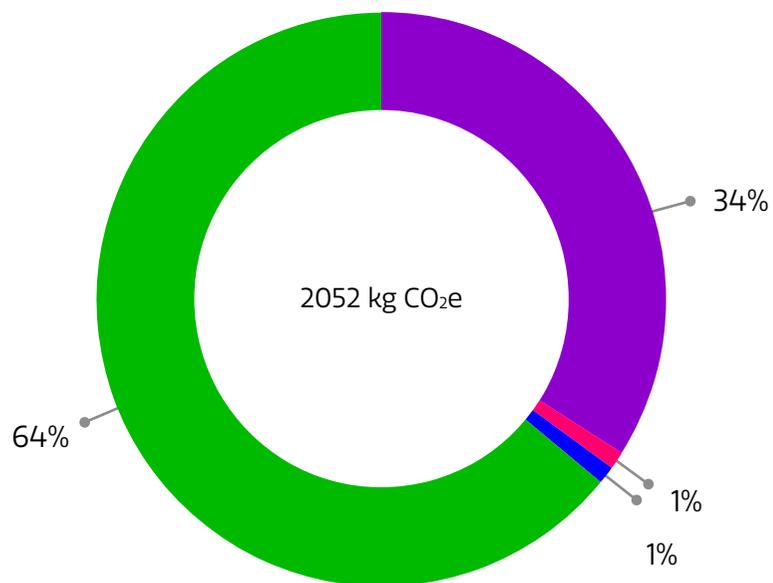
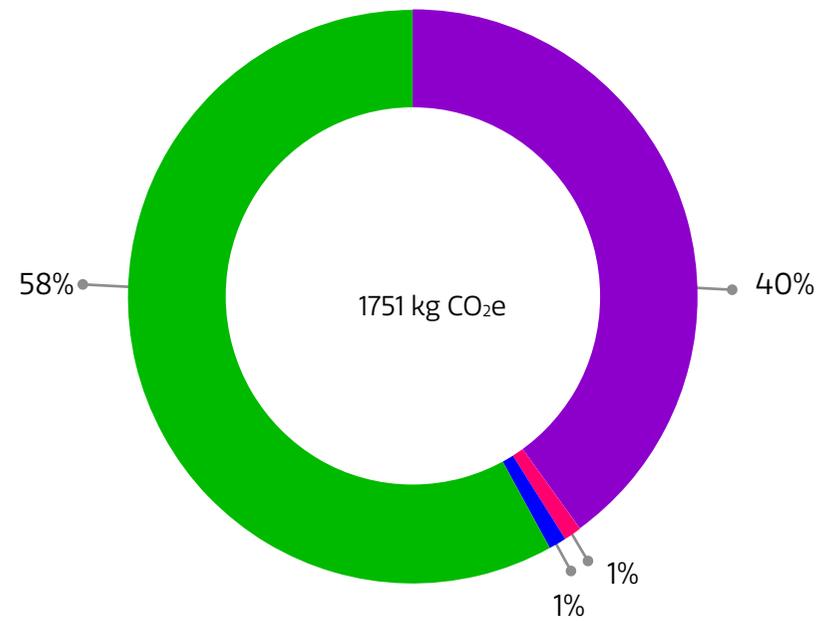**CO$_2$–footprint entire lifecycle (7 years) – energy use 100% energy saving mode**

34%

2052 kg CO$_2$e

64%

1%

1%

49%

1450 kg CO$_2$e

49%

1% 1%

■ Production ■ Packaging ■ Transport ■ Energy use

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Riva 86 inch

CO_2–footprint entire lifecycle (7 years) – energy use 50% energy saving mode/50% 'normal mode'

58% — 40%

1751 kg CO_2e

1%

1%
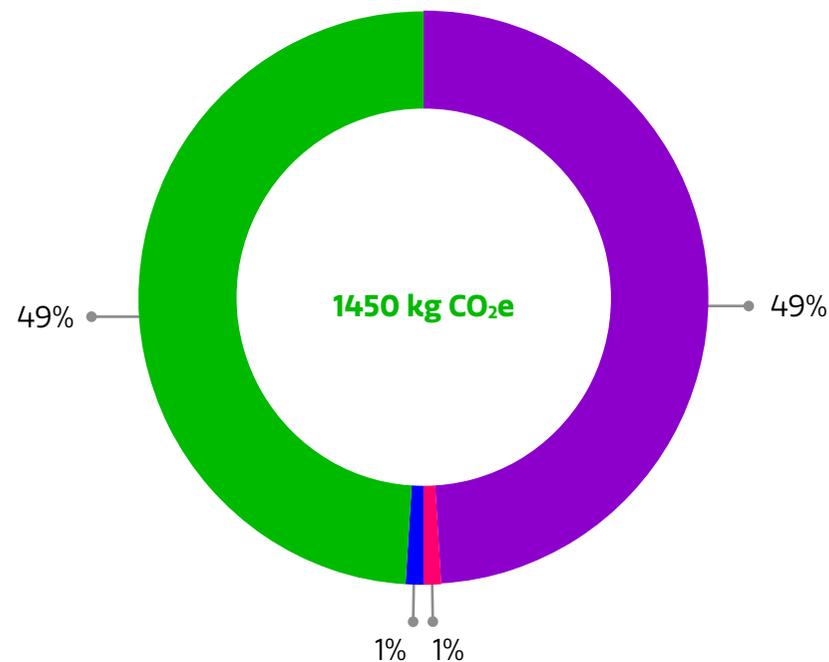
■ Production ■ Packaging ■ Transport ■ Energy use

4.
METHODS,
ASSUMPTIONS AND
LIMITATIONS

As described before, an LCA can be performed in two ways: by means of LCA software or by means of a scientific literature study. In view of CTOUCH's practical aim to make concrete improvements based on the LCA, the choice was made to determine the impact of the screens on the basis of LCAs that have already been performed scientifically. For each LCA, two factors are important: the materials present in the screen and the ecological impact of these materials during extraction, transport and production.

As multiple sources of information are used, a literature study is more transparent and precise and less data and assumptions are needed to establish a reliable LCA. Of course, this method also has limitations.

One of them is that the values found in the literature apply to the specific products described in the literature. They can therefore give an estimate for the CTOUCH screens, but the values are probably different for each situation. That is also why different values are found in the literature for the same materials and components.

Another disadvantage is that each relevant LCA found in literature focusses on CO_2-emissions. This means that a qualitatively proper analysis of other impact categories such as material use or toxicity is not possible. What did stand out in the literature is that there is a relationship between a high CO2 impact for a certain material and a high ecological impact in other environmental categories. This means that measures that reduce CO_2 emissions most likely also reduce other harmful categories.

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In general, it is very difficult to conduct an accurate ecological impact analysis. Such an analysis requires detailed data and product information where the lack of data on the production process and the environmental impact of individual materials/components is the main barrier. Little information is available from the manufacturer as the manufacturer itself has no information from its suppliers. This was also highlighted in the study of 5. The only option to further improve the LCA and include other impact categories is to analyse each component in the screen, possibly by means of a professional materials analysis or by gathering data throughout our value chain. From this material analysis, the ecological impact can be determined by means of professional LCA software. Of course, this also involves limitations and assumptions, mainly because the origin and impact of each material is difficult to determine5.

Other assumptions taken in this research are:

Transport includes the transport of the finished product from the factory to the customer. All transports of raw materials and individual parts are not included. The assumption is that this transport of individual materials (e.g. bauxite from the mine to the factory) is included in the production values of 3.1.1.

The end-of-life impact is not included as it is very small on the basis of the literature.

5.
CONCLUSION &
INITIATIVES

This report shows that the production and use phases of interactive touchscreens are the phases with the greatest environmental impact. In order to reduce this impact, CTOUCH is committed to:

1. Optimise the production process (less/better use of materials and less use of energy)
2. Optimise energy use during lifetime
3. Extend the useful lifetime of the screens
4. Recycle and repurpose screens as optimally as possible at the end of their useful life

There are two ways to save energy while using the screen: by designing the screen in an energy-efficient way (e.g. with energy saving features) and by helping the end-user to save energy. An example of this is the use of the energy-saving mode, which can save approximately 40-50% energy.

Different circular business models can be used to extend the lifespan of the screens, namely refurbishing, modular & upgradable screens and as-a-service models. In terms of recycling, CTOUCH is working with WEEENL, which, as a service partner, realizes the recycling infrastructure for the screens.

Additionally, CTOUCH offers a financial benefit to companies that would like to replace their CTOUCH touchscreen at the end of their business usage lifespan with new technology. This allows CTOUCH to take ownership by repurposing their touchscreens and it brings value to companies that aim to contribute to sustainability and circular business models.

CTOUCH has already implemented the following measures:

⊘ In 2019, we carried out the first LCA for our previous screens, the CTOUCH Leddura and the CTOUCH Laser, and drew important conclusions from this in terms of CO_2-impact.

⊘ In 2020, we carried out LCAs for the CTOUCH Riva and the CTOUCH Canvas, in order to gain insight into CO_2 emissions here as well.

⊘ For each touchscreen, a CO_2 & Materials passport is developed. This increases the level of CTOUCH' ownership of the used resources, accelerating the conversations with suppliers on using energy efficient materials and technology. Additionally, sustainability has become a key topic in commercial conversations with our partners and customers.

⊘ Our BRIX solution gives us a platform that makes our touchscreens modular, easy to repair and easy to upgrade. This allows us to extend the lifespan of our screens and in the future they can be used several times for different customers with different wishes. In this way, we can satisfy the needs of companies with a simple upgrade, preventing the production of an entirely new touchscreen. As a result, we save companies a lot of money and together we reduce CO_2-emissions.

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CTOUCH is currently working on the following projects:

⊘ CTOUCH is working on a pilot in which we, together with primary schools, secondary schools and the TU/e, are doing research into more energy-efficient use of the screens ("energy savings through user interaction"). The goal is to save 40-50% energy in order to achieve a CO_2 reduction of 25% over the entire lifespan. We do this by increasing the interaction with the user and by making the user more aware of our energy-saving features.

⊘ CTOUCH is working together with companies to put circular business models into practice by giving the screens a second life in an educational environment after their useful lifetime in business.

CTOUCH has defined the several initiatives for the near future:

⊘ Together with primary schools, secondary schools and the TU/e, CTOUCH intends to develop an educational module in which the concepts 'circularity', 'sustainability' and 'energy saving' are evoked.

⊘ CTOUCH plans to be the first manufacturer to earn an international environmental or eco-label.

⊘ In cooperation with WEEENL, CTOUCH wants to take more responsibility in recycling. This can be achieved by, among others, better insight into the location of the screens and the reason why they are being recycled and not re-used. We also intend to set up a collection infrastructure that will be one of the preconditions that are needed to bring circular business models into practice.

⊘ CTOUCH will continuously improve its LCAs and material passports by gaining more insight and data about the production process, material usage, energy consumption and the recycling phase.

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