CIRCULARITY &
SUSTAINABILITY
2020/2021

CTOUCH CANVAS CIRCULARITY PASSPORT

CO_2 FOOTPRINT & MATERIAL REPORT

In co-operation with
Technical University Eindhoven
Dispersed

Share, inspire, have fun!
With CTOUCH by your side.

CTOUCH®

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.

CONTENT

SUMMARY

This document explains the CO_2-impact and material use for our touchscreen, the CTOUCH Canvas. 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 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.

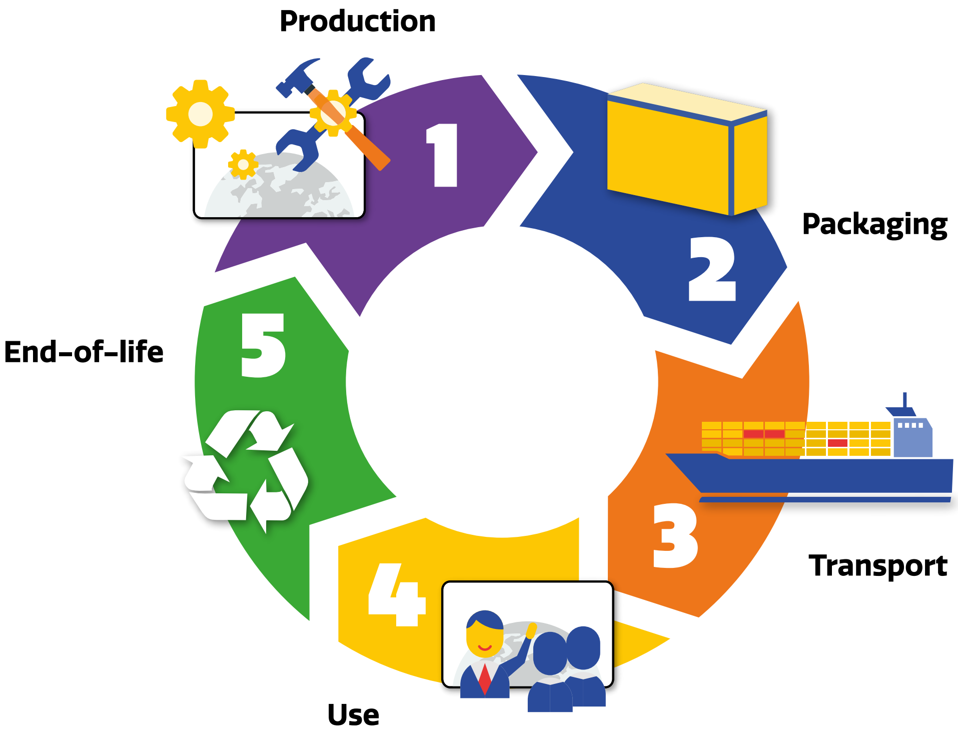
Some of the key findings of the LCA will be published in a materials passport for the Canvas that shows exactly which and how many materials are used. We are also working on a pilot in which we are researching a more energy-efficient use of the screens, together with primary schools and high schools. 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.

1. INTRODUCTION

This report provides the CO_2-impact of the entire life cycle of the Canvas 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.



2. INVENTARIZATION AND IMPACT ASSESSMENT

2.0 CO_2-impact assessment

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 Canvas. 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 CO2-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.

2. INVENTARIZATION AND IMPACT ASSESSMENT

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 Canvas is estimated to be between 10-15 kg per kg of product.

The abovementioned values provide the following top-down estimation for the Canvas:

- 65 inch (46 kg): approximately 450-700 kg CO_2
- 75 inch (58 kg): approximately 600-900 kg CO_2
- 86 inch (70 kg): approximately 700-1100 kg CO_2

2. INVENTARIZATION AND IMPACT ASSESSMENT

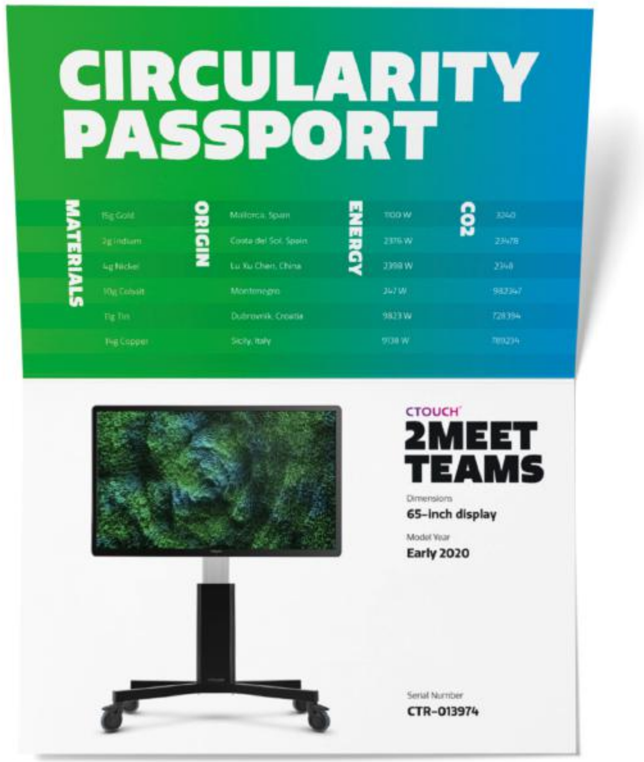
Bottom-up analysis

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.

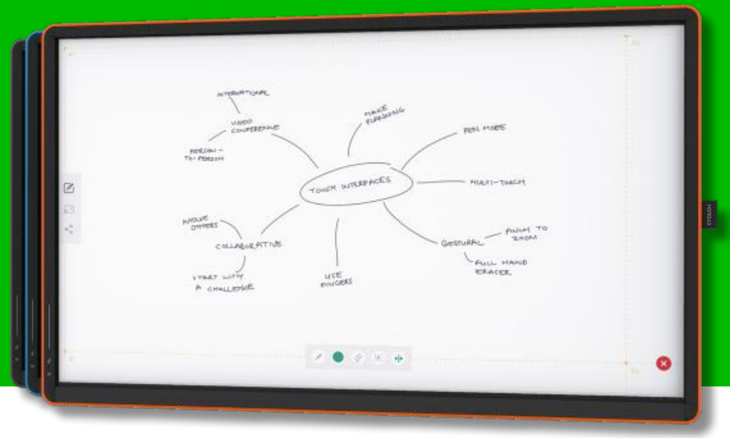
- According to Andrae et al. [4], stainless steel, iron and aluminium emit 6 grams, 6 grams and 12 grams of CO_2 per gram of material, respectively, during production. According to Sevenster et al. [6], steel and aluminium have a CO_2- impact of 1 gram and 5.5 grams of CO_2 per gram of material. Teehan [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 65-70g 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 180g CO_2/g, Teehan et al. [2] the value of 180g CO_2/g and Apple uses 370g CO_2. Our study uses the value of 370g CO_2-emissions for the mainboards including ICs and 180g for the switchboards including ICs.
- According to Andrae et al. [4], plastic (HDPE and PP) equals 2g CO_2 emissions per gram of material. According to Sevenster et al [6], the general value for plastic of 3.5g CO_2/g material can be used. In this study, 2 g CO_2/g is used, based on HDPE, as mentioned in [4].

2. INVENTARIZATION AND IMPACT ASSESSMENT

- 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 40g CO_2/g material can be used [2, figure 4.1]. In our study, a value of 40g 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 53g CO_2 per gram [2], 65g CO_2/g [2, figure 4.1, iPad], 55g CO_2/g [2, figure 4.1, LCD monitor 21.5"] or 40g CO_2/g [2, figure 4.1, LCD monitor 17"]. Apple uses 52g CO_2 per gram display [2]. This study uses 50g 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 50g CO_2/g.



2. INVENTARIZATION AND IMPACT ASSESSMENT



Results

In table 1, the materials as used in the Canvas 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 55 INCH CANVAS	GRAMS PER 65 INCH CANVAS	GRAMS PER 75 INCH CANVAS	GRAMS PER 86 INCH CANVAS
Steel	10244	11825	14757	16792
Aluminium	11572	13861	17489	20543
Glass	8700	12180	16190	21200
Mainboard incl. IC's	316	316	316	316
Switchboards incl. IC's	1500	1500	1500	1500
Display	2720	3800	4880	5900
Power supply	937	937	1431	1431
LED-backlight	1250	1412	1640	1900
Packaging (zie par. 2.1.2)	5000	7890	9640	12230

COMPONENT	GRAMS OF CO_2 PER GRAM MATERIAL	KG OF CO_2 PER 65 INCH	KG OF CO_2 PER 65 INCH	KG OF CO_2 PER 75 INCH	KG OF CO_2 PER 86 INCH
Steel	2	20	24	30	34
Aluminium	6	69	83	105	123
Glass	1	9	12	16	21
Mainboard incl. IC's	180-370	117	117	117	117
Switchboards incl. IC's	180	270	270	270	270
Display	50	109	152	195	236
Power supply	40	37	37	57	57
LED-backlight	50	63	71	82	95
Packaging (zie par. 2.1.2)	±1	9,5	11,7	14,3	17
TOTAL	-	703,5	777,7	886,3	970

2. INVENTARIZATION AND IMPACT ASSESSMENT

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 Canvas corresponds to approximately 2490 kWh electricity [7].

Petrol car - 140 g CO_2 per kilometer:
the production of a 75 inch Canvas corresponds to approximately 6230 km [8].

Cheese - 12 kg CO_2 per kg cheese:
the production of a 75 inch Canvas corresponds \ to approximately 73 kg of cheese [9].

Chicken – 14 kg CO_2 per kg of chicken meat:
the production of a 75 inch Canvas corresponds to approximately 62 kg of chicken [9].

Beef - 30 kg CO_2 per kg of beef:
the production of a 75 inch Canvas corresponds to approximately 29 kg of beef [9].

Beer - 0,3 kg CO_2 per liter:
the production of a 75 inch Canvas corresponds to approximately 2.907 liters of beer [10].

Soda - 0,5 kg CO_2 per liter:
the production of a 75 inch Canvas corresponds to approximately 1.744 liters of soda [10].

T-shirt – 12,5 kg CO_2 per T-shirt:
the production of a 75 inch Canvas corresponds to approximately 70 T-shirts [11].

2. INVENTARIZATION AND IMPACT ASSESSMENT

2.2 Packaging

The packaging of the 55, 65, 75 and 86 inch Canvas 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 9.5, 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.

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	CO_2-EMISSIONS DURING TRANSPORT [KG]
55 inch, 44.1 kg	13.2
65 inch, 54.4 kg	16.3
75 inch, 68.6 kg	20.6
86 inch, 82.7 kg	24.8

2. INVENTARIZATION AND IMPACT ASSESSMENT

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.

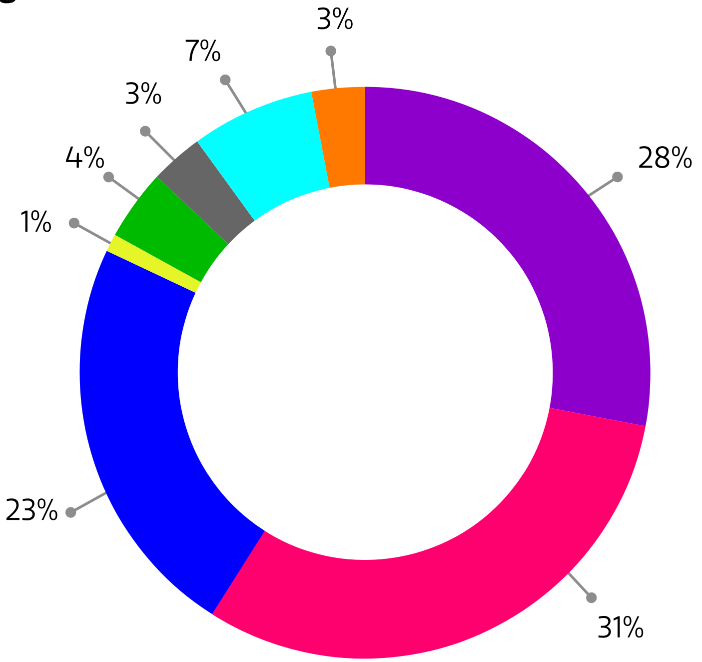
The measured values are as follows: **Power and energy consumption per touchscreen according to measurements**

TYPE	POWER [W]	YEARLY AMOUNT OF CO_2-EMISSION (BASED ON 1.460 HOURS OF USE PER YEAR) [KG]	CO_2-EMISSION OVER ENTIRE LIFE CYCLE OF 7 YEARS [KG]
Canvas: 55 inch, normal mode	156	81	565
Canvas: 55 inch, energy saving mode	71	37	258
Canvas: 55 inch, 50% normal/50% energy-saving	114	58	412
Canvas: 65 inch, normal mode	200	104	726
Canvas: 65 inch, energy saving mode	114	59	414
Canvas: 65 inch, 50% normal/50% energy-saving	157	81	570
Canvas: 75 inch, normal mode	267	138	969
Canvas: 75 inch, energy saving mode	120	62	435
Canvas: 75 inch, 50% normal/50% energy-saving mode	194	100	703
Canvas: 86 inch, normal mode	363	188	1.317
Canvas: 86 inch, energy saving mode	136	70	493
Canvas: 86 inch, 50% normal/50% energy-saving	250	129	905

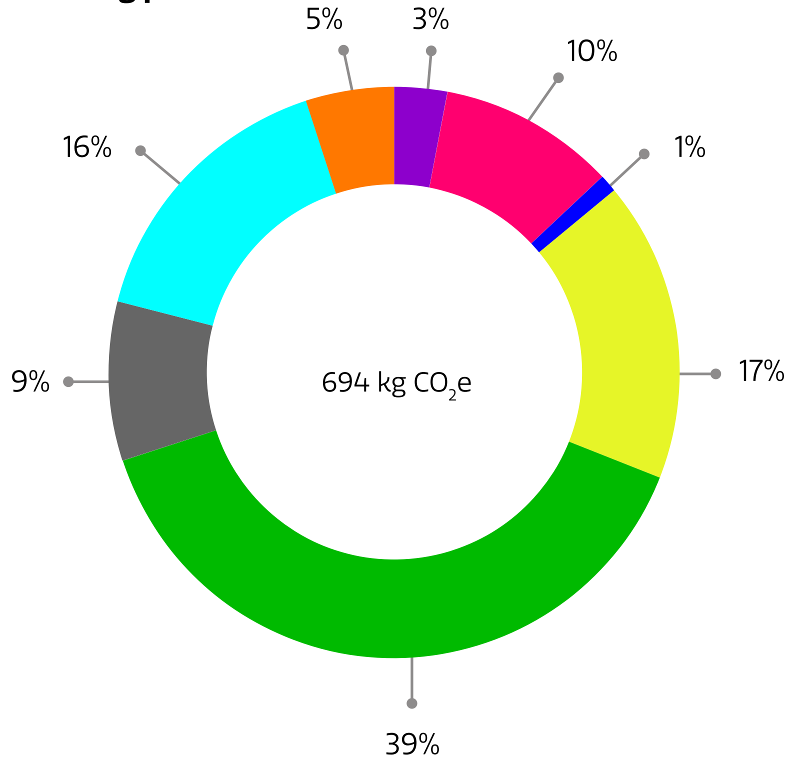
3. RESULTS

Canvas 55 inch

Material usage 55 inch



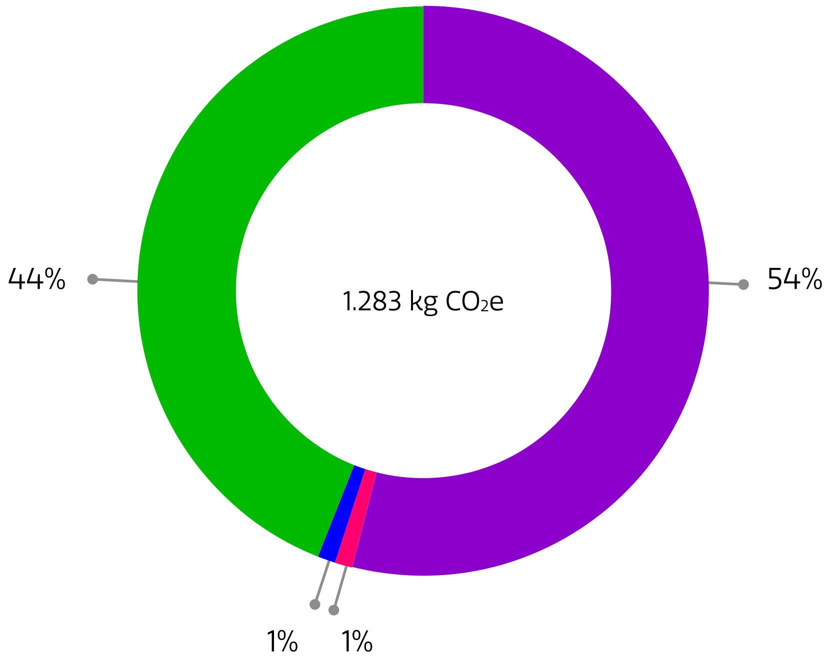
CO_2-footprint during production



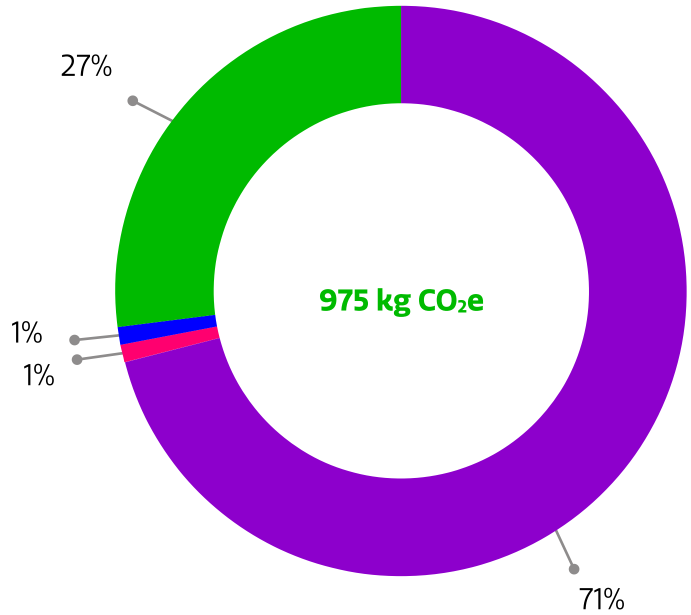
Steel
Aluminium
Glass
Mainboard including IC's
Switchboards including IC's
LED-backlight
Display
Power supply

Canvas 55 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



Production Packaging Transport Energy use

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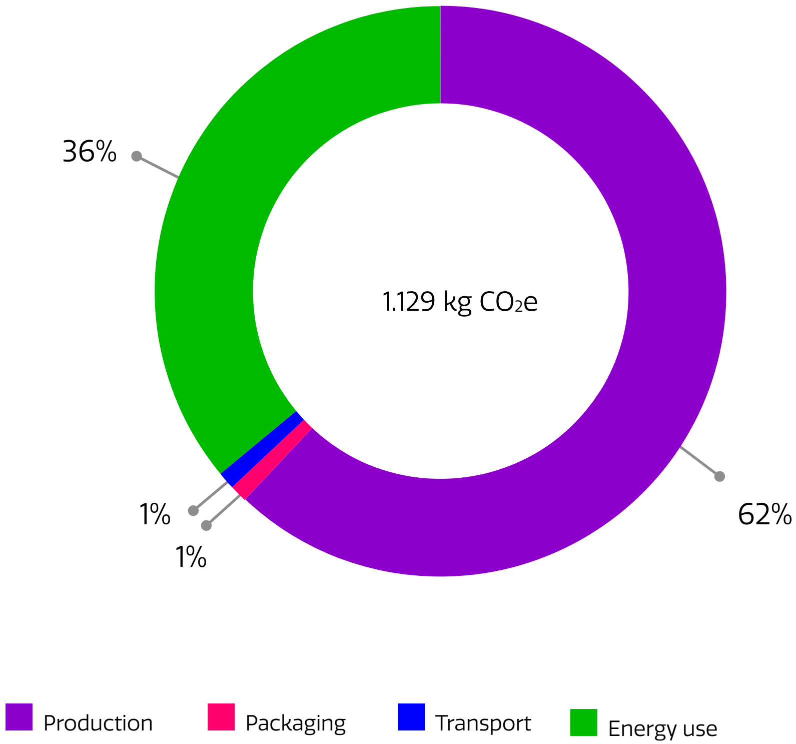
Canvas 55 inch

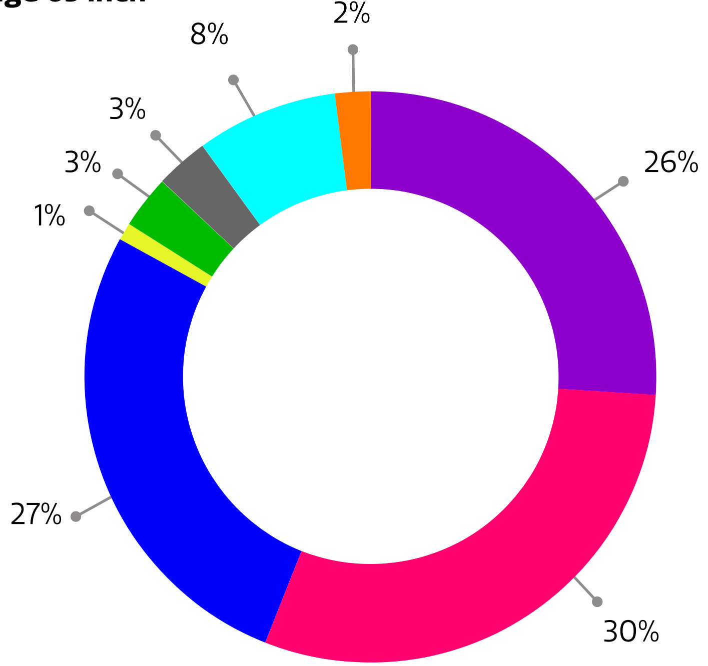
CO_2-footprint entire lifecycle (7 years) – energy use 50% energy saving mode/50% 'normal mode'



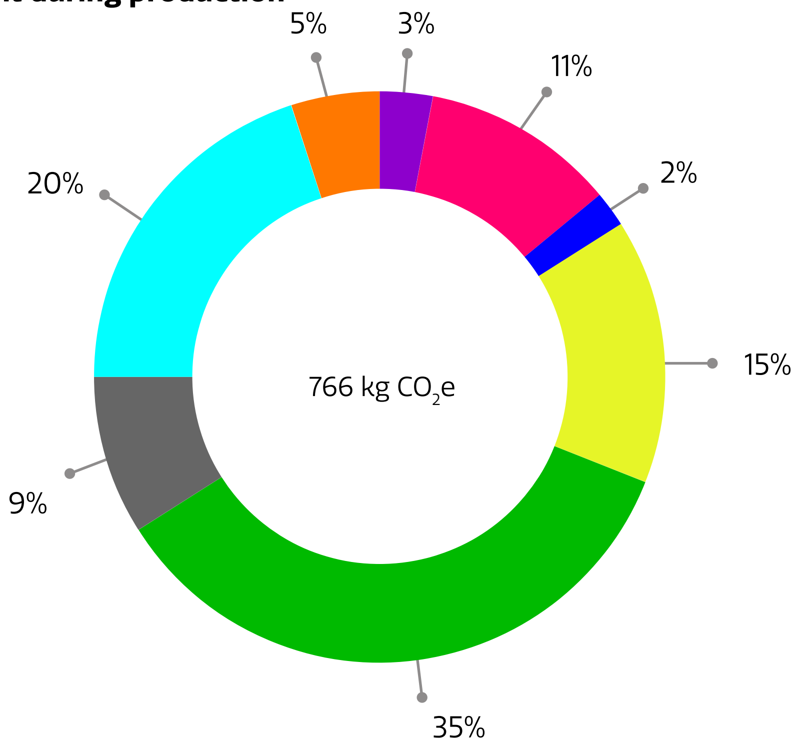
3. RESULTS

Canvas 65 inch

Material usage 65 inch



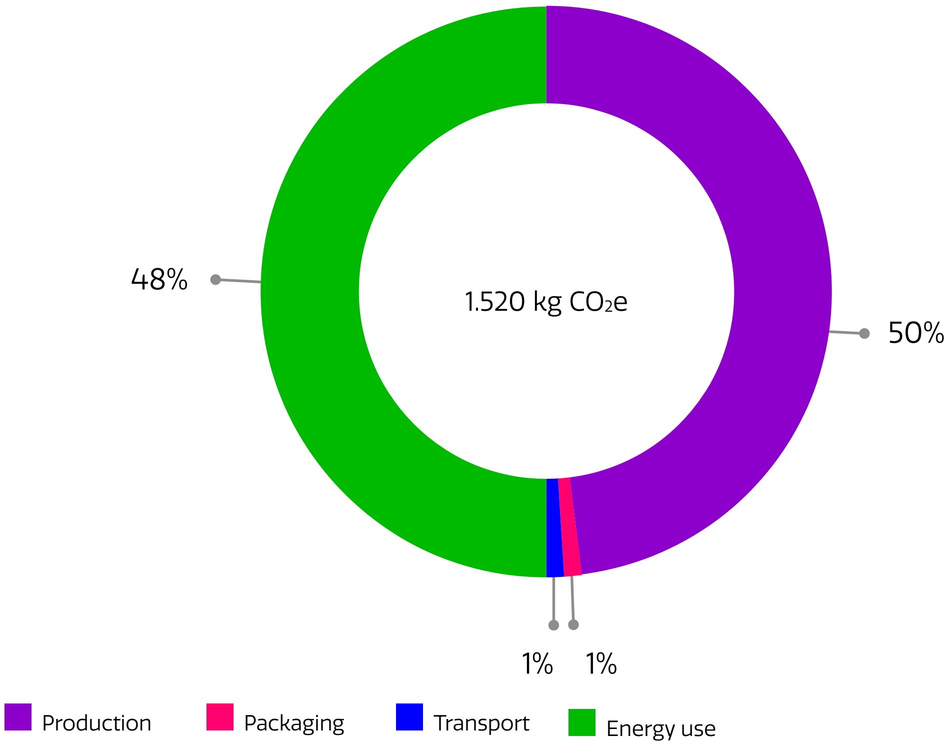
CO_2-footprint during production



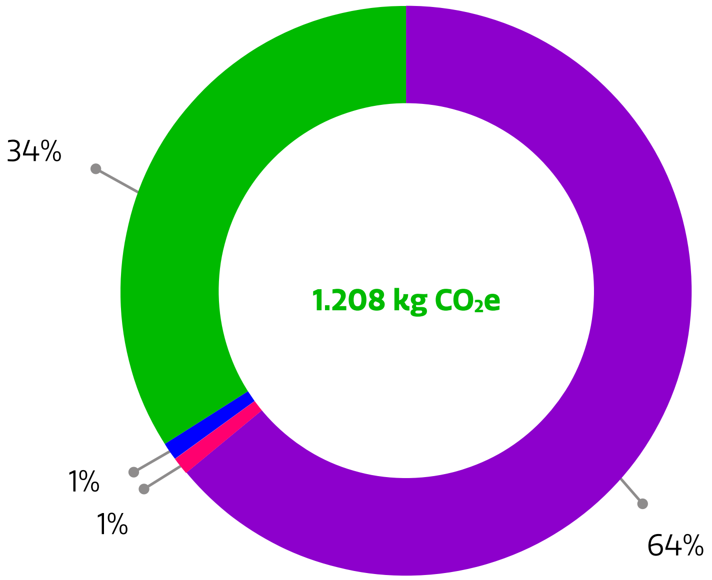
Steel | Aluminium | Glass | Mainboard including IC's | Switchboards including IC's | LED-backlight | Display | Power supply

Canvas 65 inch

CO_2-footprint entire lifecycle (7 years) – energy use 100% normal mode

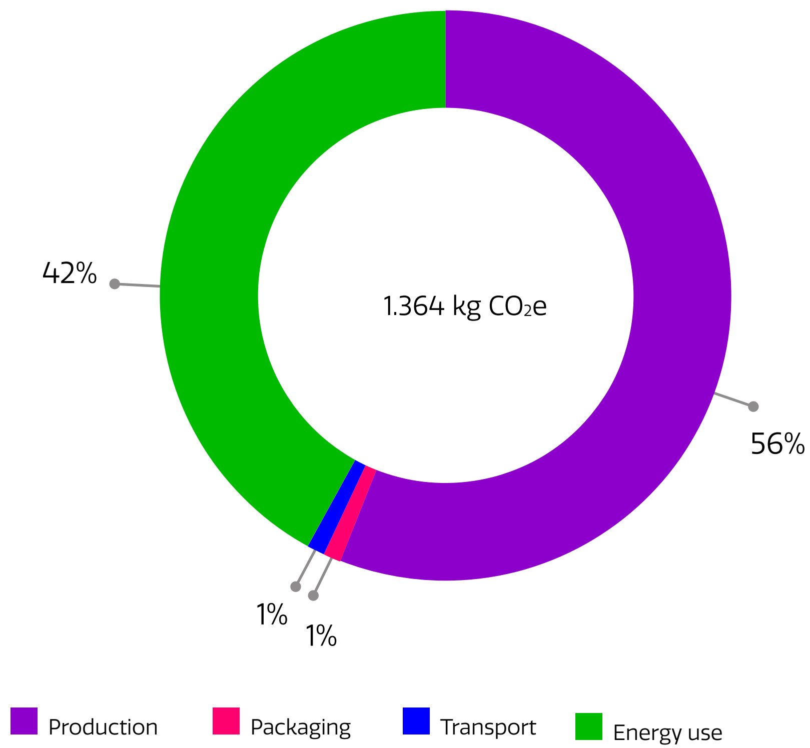


CO_2-footprint entire lifecycle (7 years) – energy use 100% energy saving mode



Canvas 65 inch

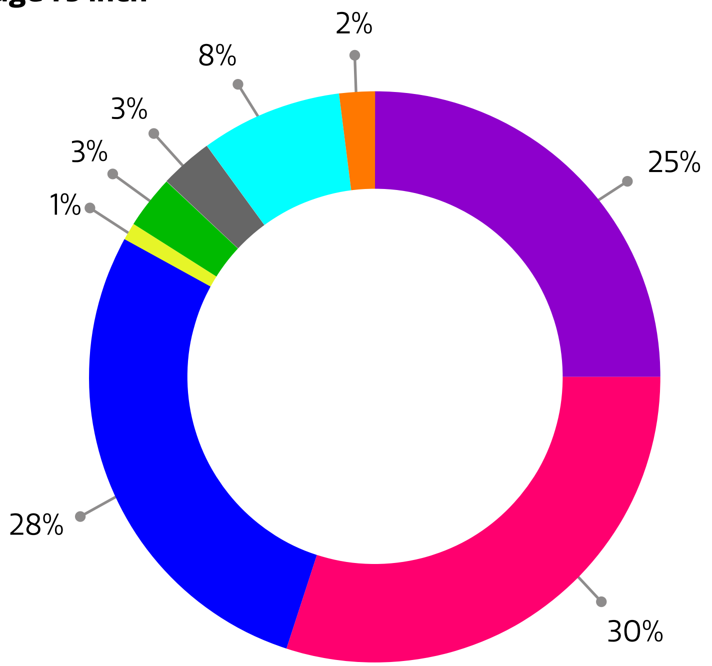
CO_2-footprint entire lifecycle (7 years) – energy use 50% energy saving mode/50% 'normal mode'



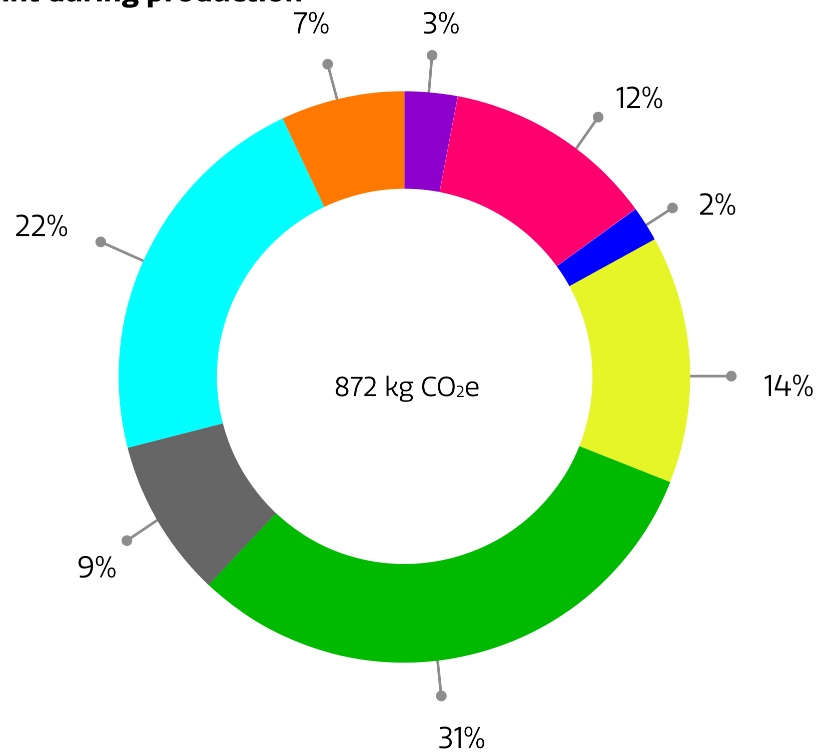
3. RESULTS

Canvas 75 inch

Material usage 75 inch



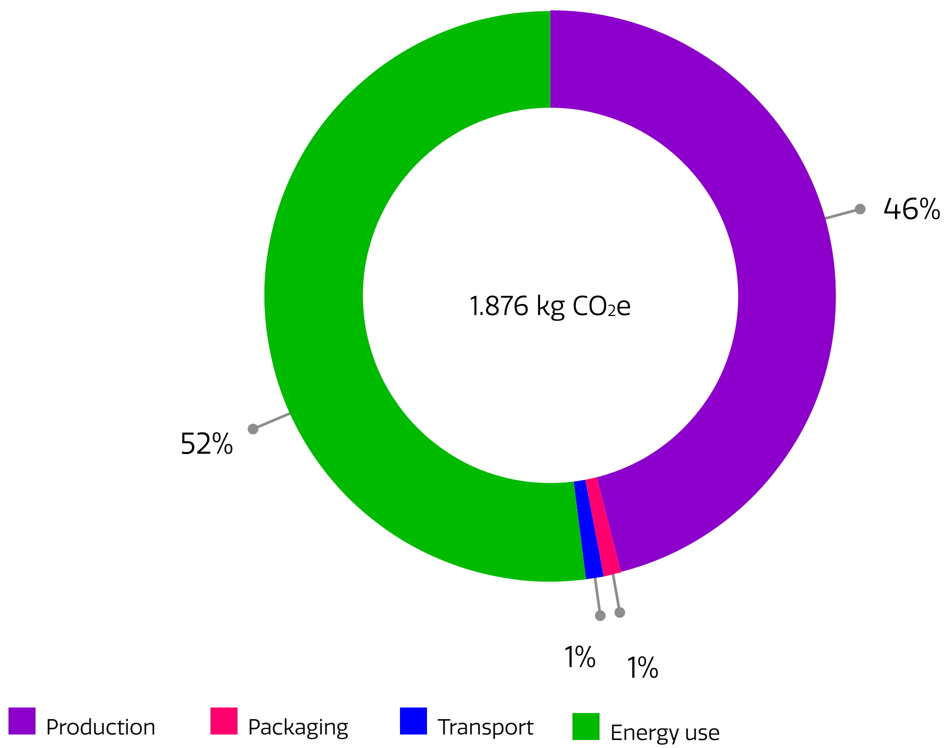
CO_2-footprint during production



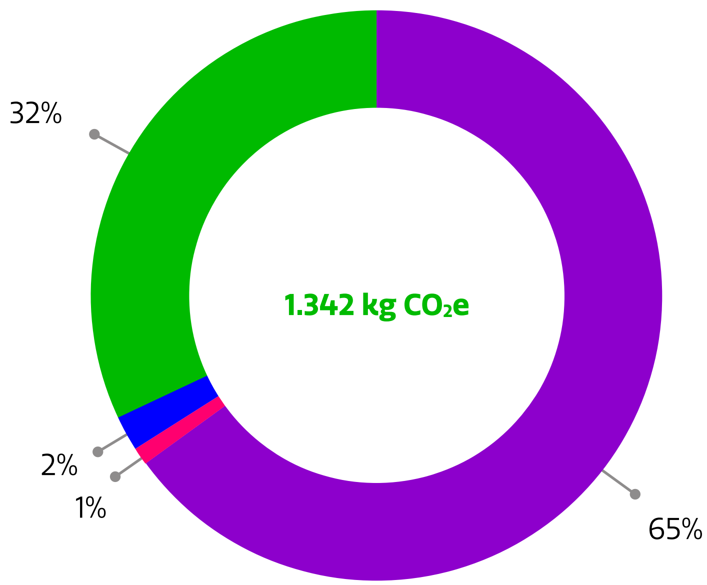
Steel | Aluminium | Glass | Mainboard including IC's | Switchboards including IC's | LED-backlight | Display | Power supply

Canvas 75 inch

CO_2-footprint entire lifecycle (7 years) – energy use 100% normal mode

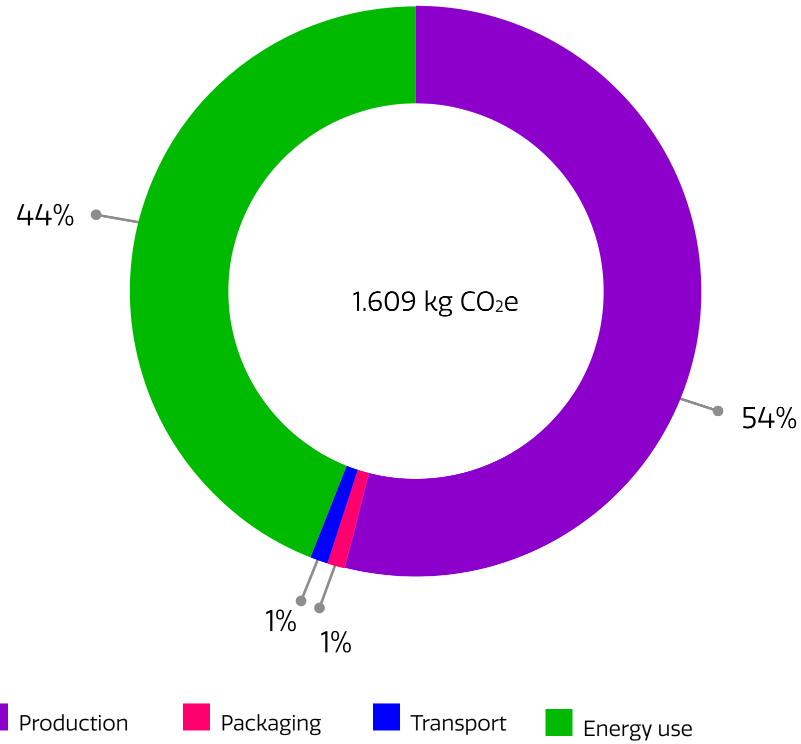


CO_2-footprint entire lifecycle (7 years) – energy use 100% energy saving mode



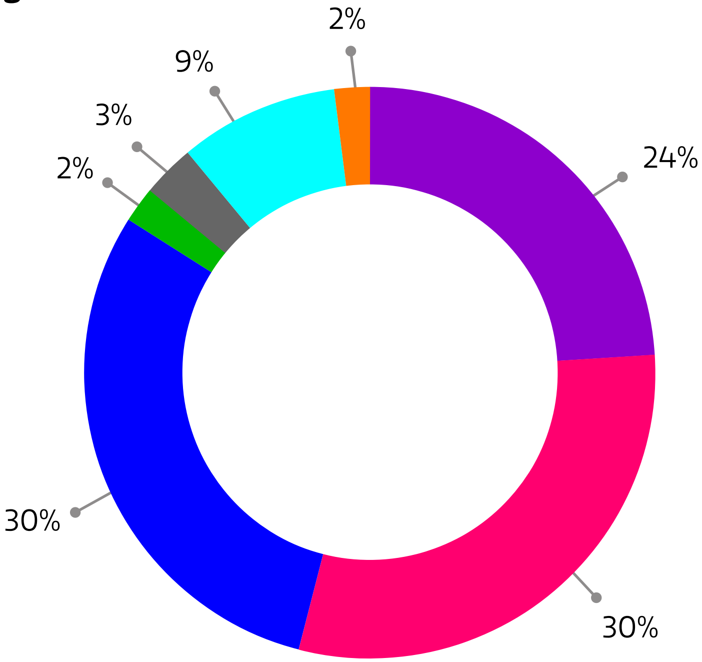
Canvas 75 inch

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

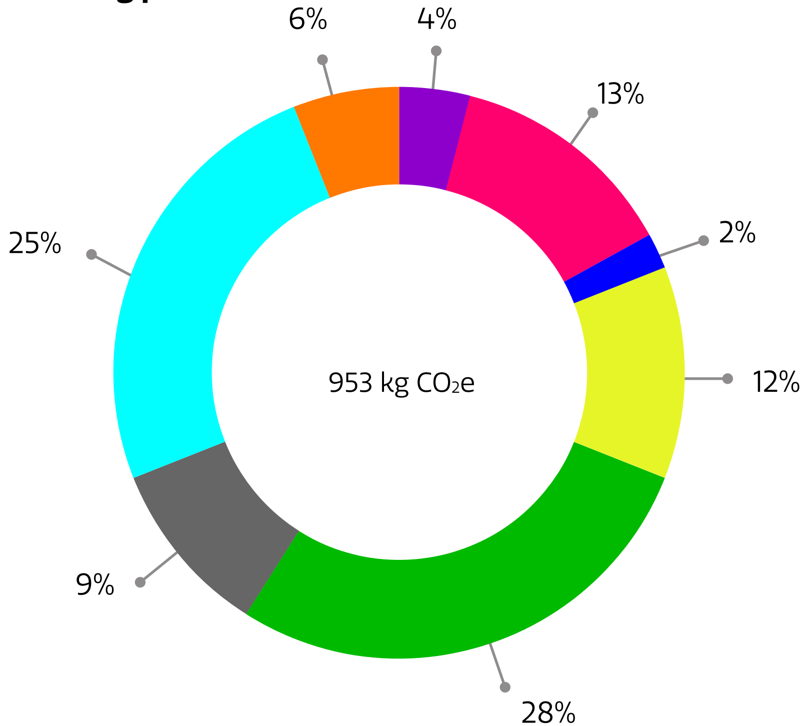


Canvas 86 inch

Material usage 86 inch



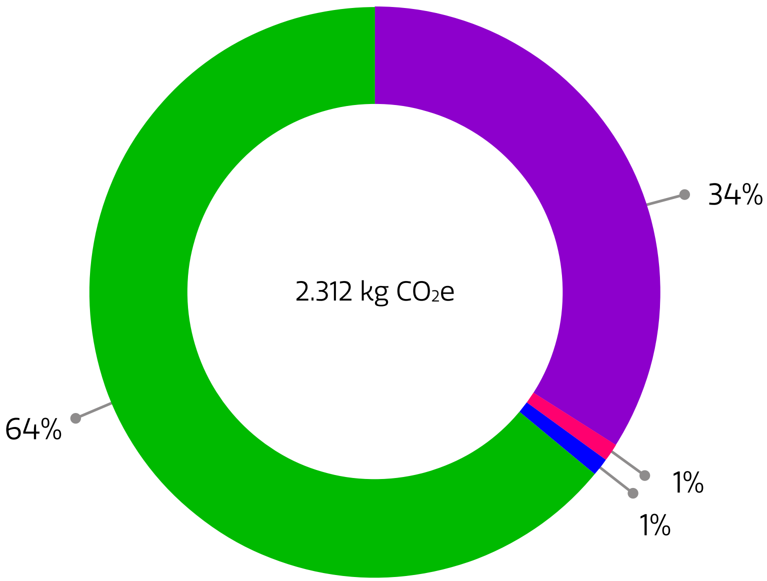
CO_2-footprint during production



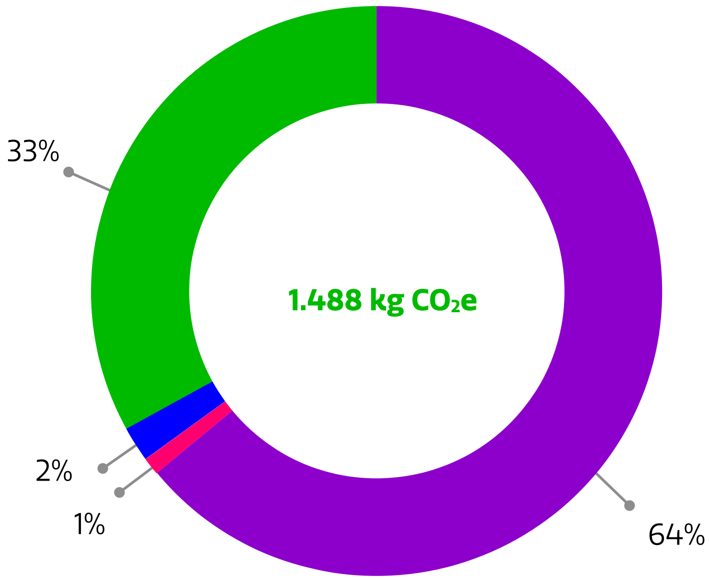
Steel | Aluminium | Glass | Mainboard including IC's | Switchboards including IC's | LED-backlight | Display | Power supply

Canvas 86 inch

CO_2-footprint entire lifecycle (7 years) – energy use 100% normal mode



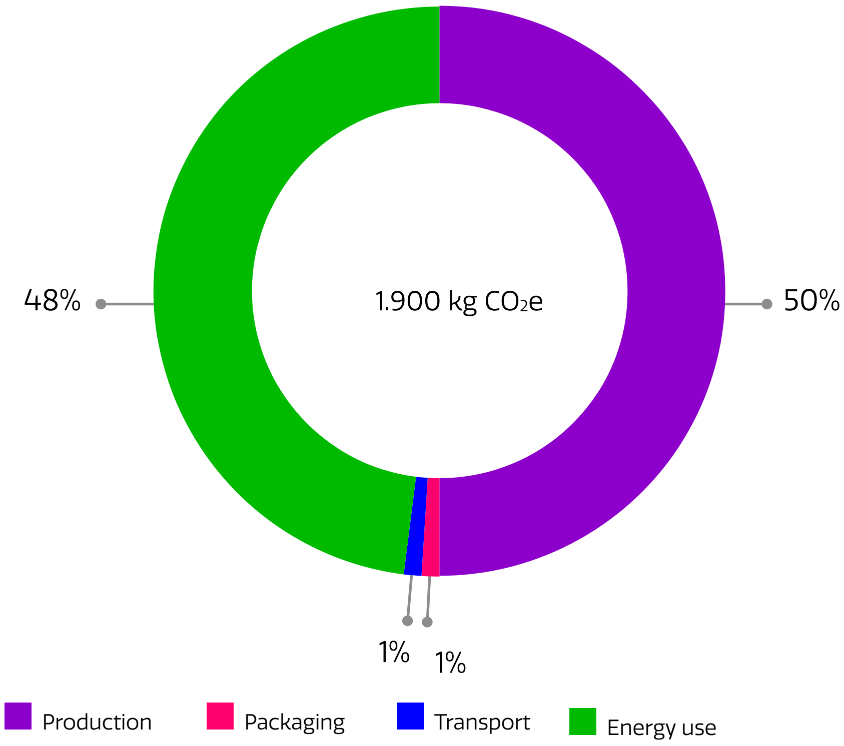
CO_2-footprint entire lifecycle (7 years) – energy use 100% energy saving mode



Production Packaging Transport Energy use

Canvas 86 inch

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



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 CO_2 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.

4. METHODS, ASSUMPTIONS AND LIMITATIONS

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 determine [5].

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.

5. CONCLUSION & INITIATIVES

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.

5. CONCLUSION & INITIATIVES

CTOUCH is currently working on the following projects:

- For the Canvas, a product passport will be designed that shows exactly which and how many materials are used, where they come from, where they have been processed and how they have been used in the touchscreens. This allows our supply chain to become more sustainable and more circular. All results are published on the website to create transparency and to help others with their sustainability challenges.
- 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 following projects for the near future:

- Together with primary schools, secondary schools and the TU/e, CTOUCH wants to develop an educational module in which the concepts 'circularity', 'sustainability' and 'energy saving' are evoked.
- CTOUCH plans to be the first manufacturer in our business 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 want to set up a collection infrastructure that will be one of the preconditions that are needed to bring circular business models into practice.
- CTOUCH wants to continuously improve its LCAs and material passports by gaining more insight and data about the production process, material use, energy use and the recycling phase.

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Looking for the perfect technological solutions for your meeting? CTOUCH helps organisations create a modern workplace in which people can collaborate more efficiently. We stimulate interactivity, productivity and involvement during meetings, workshops, and anywhere else too, for that matter. How? By implementing the endless possibilities of touch screens – for inspiration, for sharing knowledge, for so many things! That way, we provide you with support for any environment in which you would like to see or which requires more collaboration. We'll take care of that, and you'll be surprised at what we manage to achieve – guaranteed!

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