



# Executive Summary

March 2023

Pro Carton, the European Association of Cartonboard and Carton Manufacturers is pleased to present the carbon footprint for carton packaging. The carbon footprint has been calculated using latest methodologies and data. The method applied is in accordance with the frameworks set out in CEPI's "Framework for Carbon Footprints for Paper and Board Products, April 2017" and the subsequent CITPA "Guidelines for calculating carbon footprints for paper-based packaging, March 2018". As recommended by these documents, the total carbon footprint value calculated covers the cradle-to-grave carbon impact of carton packaging, taking account of fossil and biogenic greenhouse gas (GHG) emissions and removals and emissions from direct land use change (dLUC). Carbon contained within the product when it is first placed on the market is also quantified.

The carbon footprint statement was compiled and written by RISE (Research Institutes of Sweden) and the raw data and calculations were verified by ifeu (Institut für Energie- und Umweltforschung) based in Heidelberg, Germany.

## Cradle-to-grave carbon footprint of cartons, kgCO<sub>2</sub>e per tonne of cartons

	Fossil GHG emissions	Biogenic GHG emissions	GHG removals	Direct land-use	Total
<b>2021</b>	852kgCO <sub>2</sub> e	1,014kgCO <sub>2</sub> e	-1,626kgCO <sub>2</sub> e	9kgCO <sub>2</sub> e	<b>249kgCO<sub>2</sub>e</b>

It is encouraging to note that the analysis shows that the cradle-to-grave fossil GHG emissions for cartons was reduced by 17% in 2021 compared to the last calculation covering the calendar year 2018 (2021: 852kgCO<sub>2</sub>e versus 2018: 1,025kgCO<sub>2</sub>e). If the total carbon footprint is considered, including fossil GHG emissions, biogenic GHG emissions, GHG removals and direct land-use, then the reduction is increased to 24% (2021: 249kgCO<sub>2</sub>e versus 2018: 326kgCO<sub>2</sub>e).

The analysis of the 2021 footprint is more complete than in previous iterations of the analysis, with additional inputs included in the modelling of the cartonboard production (in particular, inclusion of the impact of binders) and in the modelling of the carton conversion process (in particular, inclusion of the impact of adhesives for lamination, inclusion of the impact of varnish, and inclusion of the impact of gravure printing ink). Together, these additional items account for nearly 12% of the fossil GHG emissions.

### A detailed analysis of the carbon footprint reveals that:

- **The fossil GHG emissions across the entire life cycle are 852kgCO<sub>2</sub>e per tonne of cartons**
  - o The unit processes that together constitute the production of cartonboard accounts for 86% of the total fossil GHG footprint. Of these unit processes, the most important contributing item is

emissions arising from the combustion of fossil fuels at the pulp and paper mills. Also important are emissions arising from purchased grid electricity at the mills, emissions arising from the production of non-fibre inputs at the mills (process chemicals and functional additives), emissions associated with the production of purchased fuels and emissions associated with production of purchased pulp. Emissions associated with the transport of raw materials (wood, paper for recycling, and non-fibre inputs) to the mill also contribute.

- o The unit process which together constitute the converting of cartonboard into cartons account for 18% of the total fossil GHG footprint. Of these unit processes, the most important contributing item is the emissions associated with the production of purchased electricity consumed at the converting process. Emissions associated with the production of other constituents of the cartons (inks, varnish, glues, etc) are also important, along with emissions arising from fuels consumed onsite for the print drying process and for space heating.
- o Emissions associated with the delivery of cartonboard from the mill to the converter account for 5% of the total fossil GHG footprint.
- o Due to the credit received for avoided emissions arising from the energy recovery process, there is a net credit for the end-of-life processes (accounting for -9% of the total fossil GHG footprint).
- **The biogenic emissions across the life cycle are 1,014kgCO<sub>2</sub>e per tonne of cartons**
  - o Biogenic emissions arising from the combustion of biofuels at the pulp and paper mills account for the majority of the biogenic emissions (79%). This is predominantly from the combustion of internally generated biofuels such as black liquor, plus some small emissions from purchased biofuels.
  - o Emissions from end-of-life processes account for just 18% of the Biogenic emissions. However, it should be remembered that carton packaging achieves a high recycling rate. No end-of life emissions occur within the boundaries of the analysis for the proportion of cartons that are recycled (although emissions will occur in the life cycles of subsequent products that are manufactured from the recovered fibres – the implications of this are investigated in the uncertainty analysis).
- **The emissions due to land-use (dLUC) are just 9kgCO<sub>2</sub>e per tonne of cartons**
  - o The dLUC emissions mostly arise from the production of non-fibre inputs rather than inputs of fibres from the forest, reflecting the fact that the fibres used in cartonboard production are sourced from sustainably managed forests. Forests in Europe are growing, deforestation (and emissions of greenhouse gases associated with deforestation) is not an issue that is relevant to the carton supply chain in Europe, as more trees are planted than harvested through sustainable forest management.
  - o The dLUC emissions in the life cycle for cartons are primarily associated with the production of inks used in the converting process, as the extraction of specific minerals required for e.g. ink formulations may lead to localised land-use changes that result in a net release of emissions to the environment.
- **The GHG removals across the life cycle are -1,626kgCO<sub>2</sub>e per tonne of cartons**
  - o 96% of these removals relate to the CO<sub>2</sub> flows from the atmosphere into the forests during the growth phase of the wood that provides fibres and internal bioenergy at the pulp and paper mills.
  - o The remaining removals relate to CO<sub>2</sub> flows from the atmosphere into biomass used for purchased biofuels and/or non-fibre natural and renewable raw materials (e.g. starches).
- **These emissions and removals can be summed to give us a total GHG footprint across the entire life cycle of 249kgCO<sub>2</sub>e per tonne of cartons.**
- In addition, the carbon content of the product when first placed on the market is 1,609kgCO<sub>2</sub>e per tonne of cartons. In line with the CITPA methodology, this value is provided as additional information only, and should not be subtracted from the total carbon footprint.

**The improvements in fossil GHG emissions of 17% compared to the 2018 figures are significant.** The main drivers for these reductions have been improved resource efficiency during the converting process and investments in energy efficiency and renewable energy sources at the cartonboard mills and converting operations. Further investments in resource and energy efficiency and renewable energy sources should see continued reductions in the coming years.

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