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Cartons for frozen foods are more environmentally-friendly, new report shows

August 2021 – A new report has highlighted the outstanding environmental credentials of cartonboard packaging when compared against fossil-based alternatives.

Published in June 2021, *Cartonboard Life Cycle; Comparing the carbon footprint of carton packaging against alternative solutions*, goes into the granular detail of the cradle-to-grave environmental performance of cartonboard compared to multilaminate bags and PP trays for a variety of products including two frozen food products – fish fingers and ready meals.

The study, carried out by RISE (Research Institutes of Sweden) Bioeconomy unit for Pro Carton, the European Association for Carton and Cartonboard Manufacturers, provides an insight into the relative carbon footprints for packaging in different consumer sectors, alongside detailed explanations of the factors driving those comparative footprints.

Pro Carton General Manager Tony Hitchin explains that the research compares the cradle-to-grave carbon footprint of the complete packaging solution rather than just evaluating the materials on a per tonne basis: “It’s known that the carbon impact per tonne of material is much lower for cartonboard than polymers regardless of whether you look just at fossil emissions or also take the biogenic emissions and removals into consideration (see table below). We wanted to compare products on a per unit basis too as cartonboard packaging may not weigh the same as a fossil-based solution. Furthermore, the conversion and end-of-life impacts for each of the solutions will be different. That’s why in this study we have compared specific packaging solutions for the similar products on a cradle-to-grave basis.”

Cradle-to-gate comparison of carbon footprint per tonne of material ready for conversion

Material	Total carbon footprint (kgCO ₂ e per tonne of material ready for conversion)	Fossil carbon footprint (kgCO ₂ e per tonne of material ready for conversion)	Source
Cartonboard	262	1,047	Pro Carton
Amorphous PET granulate	3,093	3,089	Ecoinvent 3.6



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PP	2,110	2,122	Ecoinvent 3.6
PVC	2,122	2,108	Ecoinvent 3.6
LDPE granulate	2,305	2,286	Ecoinvent 3.6
HDPE granulate	2,110	2,092	Ecoinvent 3.6

RISE’s cradle-to-grave comparison ensures that the *entire* lifecycle of packaging is taken into account – from how it is produced (or grown in the case of the wood used in cartonboard manufacture) to processing and disposal. The study reports both fossil green-house-gas (GHG) emissions *and* biogenic GHG emissions and removals.

Fossil GHG emissions arise from non-renewable sources such as fossil fuels, while Biogenic emissions arise from the combustion of biofuels and the degradation of bio-based products. Biogenic removals refer to CO₂ uptake from the atmosphere through photosynthesis during biomass growth.

Stresses Hitchin: “Whilst the unique aspects of the life-cycle of fibre-based packaging are taken into account when calculating the total carbon footprint we also wanted to see what the results would be when only the fossil green-house-gas (GHG) emissions were considered and the cartonboard solution gave a favourable result.”

Case Study 1: Frozen Food Packaging – Battered fish



This case study compared a cartonboard box and multilaminated bag for battered frozen fish.

Comments Hitchin: “The table below shows that the multilaminated plastic bag has a higher impact than the cartonboard box when considering the impact per functional unit.”



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Case study 1: Battered fish – kgCO₂e per 1,000 packs (Total GHG does not add up due to rounding)

	Fossil GHG emissions	Biogenic GHG emissions	Biogenic GHG removals	dLUC emissions	Total GHG emissions and removals
Cartonboard box	18.1	18.1	-29	0.2	7.3
Multilaminate bag	30.6	0.4	-0.9	0.9	31

Comparative results

From the perspective of Fossil GHG emissions only, the cartonboard box had a lower impact (18.1kgCO₂e per 1,000 packs) compared to the multilaminate film bag (30.6kgCO₂e per 1,000 packs).

However, when biogenic emissions, removals and dLUC (direct land use change) were also considered, the advantage of the cartonboard pack (7.3kgCO₂e per 1,000 packs) compared to the multilaminate film bag (31.0kgCO₂e per 1,000 packs) significantly increased. This is mainly due to the uptake of carbon during the growth phase of the forests. This biogenic carbon removal was larger than the biogenic emissions that occurred (from the combustion of biofuels at the mill) during the manufacture of the board.

Hitchin also underlines that paper-based packaging has high recycling rates. “This means that a proportion of the original carbon contained in the product when it first comes to market, continues through the life-cycle of subsequent products outside the boundaries of this analysis,” he says.

He adds: “In the comparison, it is assumed that cartons are recycled at a rate of 84.6% (the European recycling rate for paper and cardboard packaging) and the laminate pouch is considered to be non-recyclable. However, recycling rates will, of course, vary from country to country.”

Case Study 2: Frozen Food Packaging – ready meal



This case study compared a cartonboard tray with a film lid, inside a cartonboard box and a PP tray with film lid in a cartonboard box.

Case study 2: Ready meals – kgCO₂ per 1,000 packs

	Fossil GHG emissions	Biogenic GHG emissions	Biogenic GHG removals	dLUC emissions	Total GHG emissions and removals
Cartonboard tray with enclosing film in a cartonboard box	66.5	49.4	-79.1	0.4	37.2
PP tray with film lid in a cartonboard box	79.3	32.0	-56.2	0.3	55.4

Comments Hitchin: “Once again the results prove that the PP tray packaging format has a higher impact than cartonboard per pack.”

Comparative results

From the perspective of fossil GHG emissions only, the cartonboard tray had a lower impact (66.5kgCO₂e per 1,000 packs) compared to the PP tray (79.3kgCO₂e per 1,000 packs). When biogenic emissions and removals and dLUC were also considered, the advantage of the cartonboard tray (37.2kgCO₂e per 1,000 packs) compared to the PP tray (55.4kgCO₂e per 1,000 packs) significantly increased.



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Commenting on the results, Pro Carton's Hitchin concludes: "It's clear that cartonboard consistently scores better than its fossil-based packaging counterparts. Cartonboard clearly offers a protective, convenient, and customer-friendly alternative to conventional plastic packs.

"We know from other research that consumers have an overwhelming preference for cartonboard packaging over plastic and this study further supports the merits of changing to cartonboard packaging."

The full report can be found here: <https://www.procarton.com/publications-news/publications/>

Ends

Notes to editors:

For further information or a full copy of the report please contact the Pro Carton press office on +44 (0) 20 7240 2444 or procarton@stormcom.co.uk

About Pro Carton

Pro Carton is the European Association of Carton and Cartonboard manufacturers. Its main purpose is to promote the use of cartons and cartonboard as an economically and ecologically balanced packaging medium.

<https://www.procarton.com>