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## Cartonboard beats PET trays for takeaway food in detailed study of comparative carbon footprint

**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 for take-away food packaging compared to a PET tray with lid.

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 comparing 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 fossil carbon footprint per tonne of material ready for conversion

Material	Total carbon footprint (kgCO <sub>2</sub> e per tonne of material ready for conversion)	Fossil carbon footprint (kgCO <sub>2</sub> 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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<b>PP</b>	2,110	2,122	Ecoinvent 3.6
<b>PVC</b>	2,122	2,108	Ecoinvent 3.6
<b>LDPE granulate</b>	2,305	2,286	Ecoinvent 3.6
<b>HDPE granulate</b>	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 CO<sub>2</sub> 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: Fast Food Packaging



This case study compared two take-out salad solutions – a folding cartonboard box and a PET tray with lid. The cartonboard box weighed 19.5g and the PET box and lid 12g & 3g, respectively. A recycling rate of 84.6% is considered for the cartonboard packaging, reflecting the average European recycling rate for paper and board



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packaging (European Commission, 2017). For the non-recycled portion of the cartonboard packaging, 8.5% is assumed to be sent for energy recovery and 6.9% is assumed to be disposed of in landfill (European Commission, 2015). A recycling rate of 41.8% was considered for the PET tray and lid, again reflecting the average European recycling rates for all plastic packaging (European Commission, 2018).

**Case study: Takeout salads – kgCO<sub>2</sub>e per 1,000 packs (The 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
Folding cartonboard box	20.3	20.8	-33.3	0.2	7.9
PET tray and lid	62.4	0.9	-0.9	0.0	62.5

Comments Pro Carton’s Hitchin: “The figures in this table clearly show that the PET tray and lid have a much higher carbon footprint than the cartonboard box when considering the impact per 1,000 units.”

**Comparative results**

From the perspective of Fossil GHG emissions only, the cartonboard box (20.3kgCO<sub>2</sub>e per 1,000 packs) had a lower impact compared to the PET tray and lid (62.4kgCO<sub>2</sub>e per 1,000 packs). However, when biogenic emissions, removals and dLUC (direct land use change) were also considered, the advantage of the cartonboard box (7.9kgCO<sub>2</sub>e per 1,000 packs) compared to the PET tray and lid (62.5kgCO<sub>2</sub>e per 1,000 packs) significantly increased as a result of the uptake of carbon during the growth phase of the forests. The 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.

As previously underlined, paper and cardboard packaging has a high recycling rate and a high proportion of the original carbon contained in the product, when it is used for the first time, is carried through to the life-cycle of subsequent products outside the boundaries of this analysis. The carbon contained in the recovered fibres will be passed on to other products until recycling of the fibres is no longer viable, at which stage the fibres will be sent for either incineration with energy recovery or landfill, with associated emissions to consider.



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The results of this case study were also subjected to sensitivity and uncertainty analysis; in particular, the recycling rate for both the cartonboard box and the PET tray and lid was tested.

Adds Hitchin: “Analysis also shows that the results for the cartonboard box are sensitive to the end-of-life scenario. However, the comparative standing of the two systems is unchanged no matter what combination of end-of-life scenarios is considered. But I can only underline the importance of recycling all cartonboard packaging.

“It’s clear that cartonboard consistently scores better than its fossil-based packaging counterpart. Cartonboard clearly offers a protective, convenient, and customer-friendly alternative to conventional blister 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](mailto: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>