An environmental comparison of paper and plastic labels

Chris Edwards & Gary Parker
Intertek Expert Services
Introduction

To provide retailers with an understanding of the carbon footprint of paper and plastic labels, Papico and Brigl & Bergmeister commissioned Intertek Expert Services to conduct a streamlined comparison.

The study compared results based on
(1) draft WRAP data
(2) existing Ecoinvent data
(3) data from a ‘best in class’ paper mill

In each case the study included the production, transportation, disposal and recycling of both labels.

Ecoinvent data is the standard data used by most life cycle assessment studies around the world.

WRAP data is being developed from Ecoinvent and other data sources to reflect UK conditions and the specific requirements of WRAP. In particular, the WRAP data will form the basis of the Courtauld II commitment, which is how UK retailers will be measuring their carbon footprint. For example Asda is developing its own sustainable packaging scorecard, and the carbon footprint data in that will be based on WRAP’s data.

The ‘best in class’ data is based on Brigl & Bergmeister’s Austrian ‘eco-mill’ using renewable energy (hydro power and thermal recovery) to produce paper.

The following slides outline specific issues regarding the methodology used and the results of the assessment conducted.
A carbon footprint is an output of a Life Cycle Assessment (LCA) which analyses the impact of a product or service from the extraction of raw materials to the disposal of generated waste through landfill and incineration.

This study provides a streamlined ‘cradle to cradle’ assessment of paper and plastic and includes the production and delivery of materials, polymerisation, extrusion and thermoforming, transportation and waste processing.
Over the last decade a number of standards have been created, such as PAS2050, to ensure that carbon footprints can be comparable.

The Courtauld II commitment, which aims to reduce the carbon emissions of packaging by 10%, is based partially around this methodology and has two important rules regarding:

- Biogenic CO2
- Recycling and recycled content

The following slides outline the importance of these issues and the rules surrounding them.
Biogenic CO2

Biogenic CO2 is the absorption and release of greenhouse gases by paper (and other biomass) during the short term carbon cycle. However, whether biogenic CO2 is included in data generally depends on the product.
For long term products, such as wooden building materials or furniture, it is likely that the material will last a long time without biodegrading. In these cases the benefit of the absorption of CO2 by growing trees is included in the data but the release of CO2 during biodegradation is not. This gives these products a net carbon benefit.
In some other cases, where material is sourced unsustainably for short term products, the absorption of CO2 is not included in the lifecycle and the degradation is, providing a net burden.
However, the methodology used by WRAP assumes that the source is sustainable and the lifecycle is short. Therefore, biogenic factors are excluded as they are assumed to be balanced (the amount absorbed as trees grow equals the amount released at the end of the paper product’s life).
The way recycling is counted in the data also affects results. The inclusion of recycled material in a product reduces the requirement for virgin material. Therefore, the closed loop recycling process used to generate this material is used to represent the recycled content of the material.
Recycling and recycled content

However, in some cases materials are not recycled for use in their original application. When this occurs, the recycled material avoids the use of the virgin material used in some new application.

Therefore, the impact of that avoided virgin material is subtracted from the system of the original product to show a benefit.

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Carbon Footprint of Paper and Plastic Labels

September 2010
In the case of paper recycling, the methodology assumes that all recycled material is recycled back into the original product.

For example, if your recycled content is 40% and the national recycling rate is 80%, the system will assume that the 40% that isn’t recycled into your product is recycled into very similar products, avoiding the same material.

In other words, credit for paper recycling is already built into the data. Therefore, you gain no benefit for the use of recycled material unless your recycled content is higher than the national recycling rate of 80%.
Recycling and recycled content

However, plastics are handled differently. In the case of plastics the methodology assumes that the open loop recycling of plastics results in the avoidance of lower grade materials such as wood. This is because recycled plastic is generally recycled into lower-grade materials such as plastic wood substitutes.

This means that the inclusion of any recycled content in plastic provides a reduction in carbon footprint.
Results

The assessment compared wrapping paper labels with extruded polypropylene labels on a gram for gram basis. This part of the study compared results gained using two datasets:

- Data derived from draft data developed by WRAP to generate initial carbon footprints for the Courtauld II commitment.
- Production and end-of-life material data from Ecoinvent 2.1.

The following sheets present the results and analysis of this assessment.
If no action is taken to reduce global emissions, average temperatures are likely to rise by more than 2 degrees Celsius.

This change will increase severe weather such as tropical storms, droughts and extreme heat waves and heavy precipitation.

Stabilisation would require emissions to be at least 25% below current levels by 2050.
Plastic carbon footprint: 2.8 – 3.2 grams CO2eq per gram of PP

Paper carbon footprint: 1.1 – 1.2 grams CO2eq per gram of paper

In carbon footprint terms, paper is a far better performer per gram of material.
The carbon footprint of the plastic label was found to be **2.8-3.2 grams CO2eq** per gram of material, while the paper label was found to be between **1.1 and 1.2 grams CO2eq** per gram of material.

The range is due to the fact that Ecoinvent data was found to give slightly higher figures than the draft data produced by WRAP (for both materials) due to somewhat different assumptions and underlying datasets used.

*In carbon footprint terms paper is a far better performer than plastic per gram of material*
The study found that the difference between Ecoinvent and WRAP data was minimal.

Both datasets showed that, gram for gram, paper had a **62% lower carbon footprint** when compared to polypropylene.
If a paper label weighed 65 grams, a PP label would have to weigh less than 24.9 grams to have a superior carbon footprint.
The results show that even if it was possible to make a plastic label from 100% recycled PP, gram for gram it would still have a larger carbon footprint than paper.
Renewable energy

Additional information from the label paper manufacturer Brigl & Bergmeister (B&B), indicates that their ‘eco-mill’ in Niklasdorf, Austria, uses renewable hydro power and thermal recovery on site.

Using the Nikasdorf production data instead of WRAP’s production data (which is based on typical mills rather than ‘best in class’ mills), the carbon footprint of paper is reduced by 19% to 0.873 grams CO2 eq. per gram of paper. That is nearly 70% lower than a plastic label of the same weight.
Therefore, if a B&B paper label manufactured in Niklasdorf weighed 65 grams, a PP label would have to weigh less than 20.1 grams to have a superior carbon footprint.

- 20.1 gram PP label: 56.7 grams CO2 eq.
- 65 gram B&B paper label: 56.7 grams CO2 eq.
Apart from the carbon footprint issue, it should also be remembered that paper is inherently a more recyclable material, as well as being recycled far more in reality. The WRAP figures show the UK recycling percentage for paper is 80%, while the figure for plastic is 24%. This means that paper scores best under any corporate metric that focuses on recycled content or recyclability. For instance, a leading retailer’s recycling metric scores paper high (best) and plastic low (worst), on a three grade scale where materials can score high, medium or low.

The majority of paper is recycled

The majority of plastic is not recycled

September 2010 Carbon Footprint of Paper and Plastic Labels
A streamlined study was also conducted to analyse the resource depletion (use of non-renewable resources such as oil, coal, gas, minerals) when paper and PP production, disposal to landfill and incineration are considered.

This showed that the paper used 84% less resources when compared gram for gram with PP.

*Paper causes 84% less depletion of resources than plastic*
Conclusion

To conclude:

• The carbon footprint of the paper label is **62% lower** when compared gram for gram with a plastic label using WRAP data.

• The environmental performance of paper gets even better if Brigl & Bergmeister’s ‘best in class’ paper production is considered, in which case paper’s carbon footprint is **70% lower** than plastic.

• The results show that even if a 100% recycled plastic label was possible, the paper label would still be superior gram for gram.

• If the paper label weighs 65 grams the plastic label would have to be 40 grams lighter to have a lower carbon footprint (and 45 grams lighter if ‘best in class’ paper is considered).