



Life Cycle Assessment Study

DS Smith, Plastics Division has compiled an independent, scientific study to measure the overall environmental performance of bag-in-box versus alternative packaging for liquid products.

Life cycle assessment of bag-in-box

- The product life cycle
- The impact assessment
- The findings

What is life cycle assessment?

Life cycle assessment (LCA) is a technique used to quantify the environmental impact of products during their entire life cycle. The different elements of the life cycle are examined from raw material extraction, manufacture, transport and usage, through to waste processing or disposal.

For each stage an inventory is made of the energy and material consumption, and of any emissions introduced to the environment. The most familiar emission described is the carbon footprint of a particular product or process.

LCA is an objective process to evaluate the environmental burdens associated with a product, process, or activity. This is done by identifying energy and materials used and the waste released to the environment. This enables the evaluation and implementation of opportunities where environmental improvements can be made. (SETAC, 1990)



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The product life cycle

The Rapak LCA was independently undertaken by the sustainability consulting team at Pira International. It compared bag-in-box with the most common alternative packaging formats in nine product categories. In each case, the different formats were adjusted to suit a common pack size and their environmental impacts were measured across ten specific categories.

Bag-in-box was found to be environmentally competitive, and in many cases superior to, the alternative packaging formats.

The impact assessment

The LCA considered 30 different packaging materials in ten market sectors. The impact assessment used the CML method to measure the bag-in-box systems against their alternatives. The categories were:

- Abiotic depletion
- Acidification
- Eutrophication
- Global warming potential
- Ozone layer depletion
- Human toxicity
- Fresh water aquatic ecotoxicity
- Marine aquatic ecotoxicity
- Terrestrial ecotoxicity
- Photochemical oxidation



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Global warming potential

Global warming potential (GWP) or carbon footprinting measures of the volume of a given mass of a green house gas (for example, CO₂, methane, nitrous oxide) that is estimated to contribute to global warming.

How is it measured? GWP is measured in terms of CO₂ equivalents. It is an internationally accepted environmental indicator, which is used as a means of measuring the global impact on the environment.

If no action is taken to reduce global carbon emissions, average temperatures are likely to rise by more than two 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.

As a responsible packaging producer, we need to be aware of this and reduce the environmental impact of our products. We have therefore undertaken an in depth study measuring the CO₂ emission of our complete range of bag-in-box products.

Bag-in-box CO₂ emission = up to eight times lower than alternative packaging.

Key Findings

The life cycle assessment study compared 13 Rapak bag-in-box and liner systems, against 17 alternative products, in nine market categories.

Light Cycle Assessment - Findings summary

WINE

The impact assessment on wine containers considered seven different packaging alternatives.

- 2 x 1.5 litre metallised laminate bag-in-box
- 2 x 1.5 litre EVOH based bag-in-box
- A 3 litre metallised laminate bag-in-box
- 4 x 0.75 litre glass bottle
- 3 x 1 litre liquid packaging board container
- 2 x 1.5 litre aluminium pouch
- A 3 litre aluminium pouch

RESULTS

Resource efficiency was the defining factor for wine container comparison. Glass bottles performed particularly badly due to its weight - worse in eight of the ten categories including acidification and global warming.

The liquid packaging board container was worse in terms of ozone layer depletion, but it was the best option in five of the ten impact categories.

Transportation played an important factor, with bag-in-box options being superior at low distribution distances.

Overall bag-in-box containers were superior to the other packaging and competitive with the liquid packaging board. The bigger bag-in-box packs gave even greater benefits per litre packed.

	Bag-in-Box	Glass Bottles	PET Bottles	Plastics	Cardboard	Steel	Pouch
Wine	◆	◆			◆		◆
Post-Mix	◆			◆		◆	
Juice	◆		◆		◆		
Edible Oil	◆			◆		◆	
Dairy	◆			◆			

Light Cycle Assessment - Findings summary

POST MIX

The impact assessment on post-mix containers considered four different packaging alternatives adjusted to suit a functional unit of 10L.

- 1 x 10 litre aseptic bag-in-box
- 1 x 30L plastic container
- 1 x 220L plastic drum
- 1 x 10L steel container

RESULTS

The 30 litre plastic container had the most environmental impact of the four considered, due to its weight per litre and the production of the HDPE.

The 220 litre plastic drum gave the worst overall effect when the cleaning process was taken into account.

The bag-in-box option performed better in the single trip category and was competitive with the re-use options.

	Bag-in-Box	Glass Bottles	PET Bottles	Plastics	Cardboard	Steel	Pouch
Wine	◆	◆			◆		◆
Post-Mix	◆			◆		◆	
Juice	◆		◆		◆		
Edible Oil	◆			◆		◆	
Dairy	◆			◆			

Light Cycle Assessment - Findings summary

JUICE

The impact assessment on orange juice containers considered four different packaging alternatives adjusted to suit a functional unit of 10L

- 1 x 10 litre aseptic bag-in-box
- 1 x 10 litre intasept bag-in-box
- 10 x 1L PET bottles
- 10 x 1L liquid packaging board containers

RESULTS

The 1 litre PET bottle was the worst packaging of the four considered, due to its weight per litre and the impact of the bottle manufacturing process.

The liquid packaging board container gave the lowest GWP results due to its use of renewable resources and the use of biogenic substances, (wood in this case) that provided a sink for CO2 by absorbing it from the atmosphere.

The bag-in-box options were competitive due to their lower weight per litre and the use of cardboard as part of the structural aspect of the container.

	Bag-in-Box	Glass Bottles	PET Bottles	Plastics	Cardboard	Steel	Pouch
Wine	◆	◆			◆		◆
Post-Mix	◆			◆		◆	
Juice	◆		◆		◆		
Edible Oil	◆			◆		◆	
Dairy	◆			◆			

Light Cycle Assessment - Findings summary

EDIBLE OIL

The impact assessment on edible oil containers considered five different packaging alternatives adjusted to suit a functional unit of 10L

- 1 x 10 Litre MDPE bag-in-box
- 1 x 10L pail
- 1 x 10L plastic container
- 1 x 10L steel container used 100 time

RESULTS

The 10 litre pail was the worst packaging of the four alternatives due to its weight per litre and the impact of the injection moulding process.

The transportation element of the steel container is the greatest contributor. However, it required only 14 cycles before being better than the pail.

The bag-in-box option was superior due to its lower weight per litre and the use of cardboard as part of the structural aspect to the container.

	Bag-in-Box	Glass Bottles	PET Bottles	Plastics	Cardboard	Steel	Pouch
Wine	◆	◆			◆		◆
Post-Mix	◆			◆		◆	
Juice	◆		◆		◆		
Edible Oil	◆			◆		◆	
Dairy	◆			◆			

Light Cycle Assessment - Findings summary

DAIRY

The impact assessment on dairy containers considered three different packaging alternatives adjusted to suit a functional unit of 10L

- 1 x 10 litre PE bag-in-box
- 1 x 10L plastic container
- 1 x 4L plastic container

RESULTS

The four litre plastic container was the worst packaging of the three considered due to its weight per litre and the impact of the injection moulding process.

The bag-in-box option was superior due to its lower weight per litre and the use of recyclable cardboard as part of the structural aspect of the container.

	Bag-in-Box	Glass Bottles	PET Bottles	Plastics	Cardboard	Steel	Pouch
Wine	◆	◆			◆		◆
Post-Mix	◆			◆		◆	
Juice	◆		◆		◆		
Edible Oil	◆			◆		◆	
Dairy	◆			◆			

Light Cycle Assessment - Findings summary

CHEMICALS

The impact assessment on chemical containers considered five different packaging alternatives adjusted to suit a functional unit of 10L

- 10 litre metallised laminate bag-in-box
- ½ x 20 litre plastic container
- 1 x 10L cubitainer
- 1 x 10L plastic container
- 1 x 10L steel container used 100 times

RESULTS

The steel container came out best in global warming terms due to its re-use, but needs to be re-used a minimum of 82 times to remain superior to bag-in-box.

The 10L plastic container gave better results than the 20L due to its more efficient use of the HDPE in both weight per L and energy consumption during manufacture.

The bag-in-box option was superior to the cubitainer due to its lower use of raw materials and lower impact during disposal.

	Bag-in-Box	Glass Bottles	PET Bottles	Plastics	Cardboard	Steel	Pouch
Wine	◆	◆			◆		◆
Post-Mix	◆			◆		◆	
Juice	◆		◆		◆		
Edible Oil	◆			◆		◆	
Dairy	◆			◆			