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quickstart

Issue 11

Sustainable design principles for packaging

This is the eleventh in a series of Quickstarts on Design for Sustainability (D4S) with Plastics. It provides guidelines for the design of sustainable plastic packaging.

In this Quickstart:

- The role of packaging
- Fit for purpose
- Resource efficiency
- Low impact materials
- Resource recovery
- Regulations and standards

The aim of the Quickstart series is to promote the design of products and services that are sustainable—that is, products and services that contribute to social progress and economic growth, as well as providing ecological benefit, throughout their life cycle. The sustainability of a product is largely locked in at the design phase, which is why D4S is so important.

The Quickstarts are written for practitioners at every stage of the plastics product chain, including designers, polymer suppliers, product manufacturers, brand owners, specifiers and recyclers. The series also supports the implementation of PACIA's Sustainability Leadership Framework (2008), which promotes a whole-of-life approach to product innovation and stewardship and the need for step-change 'transformations' in material and resource use.

Most rigid plastic packaging is recyclable (image supplied by Vinyl Council Australia)

Unilever improved the efficiency of its detergent packaging by concentrating the product. The package won the Packaging Council of Australia's Sustainability Award in 2008[1]. (Image supplied by Helen Lewis)

Packaging cannot be considered in isolation from the product supply chain. Environmental performance needs to be balanced with essential requirements for product protection, transport efficiency and usability.

The role of packaging

Packaging has many functions. It contains and protects a product as it moves through the supply chain, from the manufacturer all the way through to the final consumer (see Figure 1). It reduces waste by ensuring the products are not damaged or spoiled before they reach the consumer and in some cases during use (eg food and pharmaceuticals). Packaging also provides essential information for consumers, such as the ingredients in a food product and instructions for the safe use or disposal of a chemical product.

Most packaging (65-70%) is used in the food and beverage industry[2], but it is also used for electrical and electronic equipment, toys, pharmaceuticals, personal care products, housewares, clothing, footwear, hardware and gardening products.

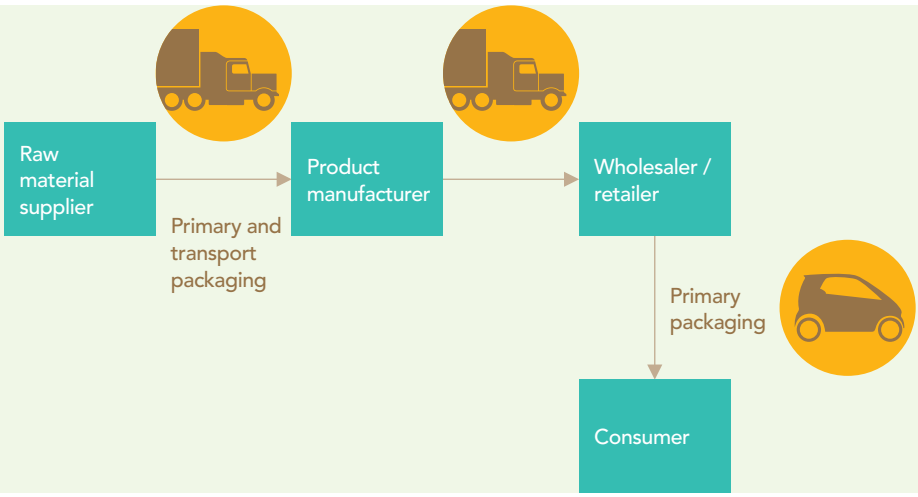
The benefits, value and potential impacts of packaging are important, and they are largely determined by packaging design. Environmental considerations need to be balanced with other important requirements such as product protection, transport and storage, cost, aesthetics, regulatory compliance (e.g. labelling) and usability. Sometimes trade-offs have to be made, and these need to be carefully considered and documented as part of the design process.

Primary packaging is used to contain and protect the product until it is consumed and in some cases while being consumed , e.g. a plastic bag, bottle or carton. It also contains information for the consumer and helps to market the product.

Secondary packaging is used to protect and unitise multiple units of a product, e.g. a cardboard box, cardboard tray or shrink film overwrap. This facilitates transport and storage.

Tertiary, transport or distribution packaging is used to secure and unitise products for transport and storage, e.g. a pallet, shrink or stretch film[3].

Figure 1: Packaging in the product supply chain



For example, a yoghurt manufacturer packs yoghurt in a plastic tub (primary packaging) for sale to the consumer. To protect the product and to facilitate transport and handling in the supply chain, a number of yogurt tubs (6-12) are packed into a corrugated box (secondary packaging). A number of boxes (20-30) are then loaded onto a pallet and wrapped in stretch film or tape to keep them stable in transport (tertiary packaging).

At the supermarket's distribution centre the stretch film or tape is removed and boxes are re-packaged for delivery to individual retail stores. The yoghurt tubs are removed from their boxes at the store and displayed in refrigerated cabinets. In this case, the only packaging that the consumer sees and takes home from the original packaging system is the primary packaging (the plastic tub). Normally the consumer would also transport their shopping in some sort of bag (tertiary packaging).

Bulk packaging improves transport efficiency (image supplied by Helen Lewis)

There are four principles for sustainable packaging which should guide the design process: fit for purpose, resource efficiency, low impact materials and resource recovery. Each of these is supported by potential strategies to assist a balanced, sustainable outcome.

Fit for purpose

Packaging needs to be 'fit for purpose', i.e. it needs to meet all the essential requirements for supply chain distribution and consumption. Strategies include[4]:

1	Ensure that the contents are delivered to the consumer in good condition.
2	Protect the contents from hazards such as vibration, heat, odour, light penetration, micro-organisms and pest infestation.
3	Ensure that the package is easy to open (but difficult to open accidentally), and as easy and effective as possible to reseal, carry and store.
4	Design the package to be pilfer-resistant and tamper-resistant.
5	For packaging of liquids, allow contents to pour without spillage.
6	For consumer goods, design the packaging to be attractive and appealing.
7	Provide information about the product, the company with responsibility for it, and instructions for handling, use and safe disposal.

Resource efficiency

Packaging consumes resources—materials, energy and water—throughout its life cycle and these should be minimised to reduce costs and environmental impact. However, strategies to improve efficiency need to ensure that product protection is not compromised. This is because the energy used to manufacture packaging and its environmental impact is generally much smaller than the energy used to manufacture the product[5]. It is therefore important to ensure that packaging is designed to protect the product and to avoid any damage or spoilage in the supply chain.

Strategies to improve the resource efficiency of plastic packaging include:

1	Use less material – downgauge as much as possible and eliminate unnecessary void space, layers and components.
2	Use plastics rather than heavier alternative materials if they meet functional and commercial requirements.
3	Design the product-packaging system to optimise transport efficiency (and therefore fuel consumption).
4	Include recycled material where this will not compromise technical performance or product protection (this saves resources throughout the life cycle).
	Minimise the use of inks where this will not compromise the consumer appeal of retail packaging.
6	Minimise product waste by allowing complete dispensing of the product (i.e. minimal residue left behind when the package is disposed of by the consumer).
7	Take steps to improve the energy and water efficiency of production and distribution processes. Consider the use of renewable energy.

Low impact materials

The environmental and health impacts associated with packaging materials and substances need to be understood and minimised. Strategies include:

1. Apply conventional risk management principles in the selection of materials and substances. Where possible, eliminate toxic or hazardous substances or minimise them where their use is necessary.
2. Aim to meet international best practice standards for the restriction of toxic or hazardous substances, e.g. the European Packaging and Packaging Waste Directive specifies that the combined weight of heavy metals (mercury, lead, cadmium and hexavalent chromium) in packaging must be less than 100 ppm[6].
3. Specify renewable or recyclable materials where these offer a genuine environmental benefit. All material selection should be based on sound science and a whole-of-life approach.
4. Use materials from suppliers with a documented environmental management system and demonstrated commitment to best practice such as signatory companies to PACIA's Sustainability Leadership Framework.

Resource recovery

The reuse and recycling of packaging reduces the amount of waste material requiring disposal and helps to conserve resources. Strategies to improve resource recovery include:

1. Consider and compare the environmental benefits of reusable packaging, particularly for secondary and transport packaging. Design reusable packaging for durability, efficient distribution and return (e.g. by designing it to be collapsible).
2. To improve the recyclability of plastic packaging:
   - try to use only one material, or material combinations that are compatible in the recycling process (see Quickstart 5)
   - if auxiliary components (e.g. caps and labels) are manufactured from a different material than the container, ensure that they can be easily separated during the recycling process
   - consult with recyclers to find out if any components will be problematic in the recovery process or end product
   - avoid wet strength paper labels on plastic packaging as they do not disintegrate into pulp during the wash phase and will contaminate the polymer
   - avoid metallic labels and aluminum closures and seals as they can severely impact the viability of polymer recycling
   - avoid pressure-sensitive adhesives that cover the entire back of the label as they are difficult to remove and contaminate the recycled polymer.
3. Consider and compare the environmental benefits of biodegradable packaging. Design biodegradable packaging to break down at the right time and in the right place (see Quickstart 4).
4. Design for litter reduction, e.g. by minimising the number of separable components.
5. Provide information on the label to encourage consumers to recover or dispose of the packaging responsibly, e.g:
   - label rigid plastic bottles and containers with the Plastics Identification Code (Figure 2)
   - label recyclable packaging with the 'mobius loop' (Figure 3). A package is considered to be recyclable if it 'can be diverted from the waste stream through available processes and programs and can be collected, processed and returned to use in the form of raw materials or products'[10]
   - label packaging which is likely to be consumed away from home with the 'Tidyman' logo (Figure 4).

Figure 2: Plastics Identification Code[7]

Figure 3: The mobius loop[8]

Figure 4: 'Tidyman' anti-litter logo[9]

There are many opportunities to improve the resource efficiency of secondary packaging. In this case a section of the box has been cut out to reduce material consumption, while at the same time allowing easy identification of the product. (Image supplied by Helen Lewis)

The Quickstart series is part of the 'Design for Sustainability with Plastics' program managed by a collaborative partnership between Sustainability Victoria and PACIA. The Quickstart series can be downloaded from www.pacia.org.au.

Regulations and standards

The environmental impacts of packaging are controlled in Australia through a voluntary agreement—the National Packaging Covenant (NPC)—and the National Environment Protection Measure (NEPM) for Used Packaging[11]. Container Deposit Legislation (CDL) and a ban on lightweight plastic shopping bags are also in place in South Australia[12].

Claims about the environmental benefits of packaging and products are regulated through the Trade Practices Act[13]. Guidelines are provided in a voluntary standard, AS/NZS 14021: 2000 *Environmental labels and declarations—self–declared environmental claims*.

Publication details

Quickstart: Design for Sustainability with Plastics was prepared by Helen Lewis Research for Sustainability Victoria and the Plastics and Chemicals Industries Association (PACIA) with input and advice from practitioners and others involved in the sector.

Further information

Packaging design guidelines

Australian Council of Recyclers (ACOR) 2006, *Recycling guide for fillers marketing in PET containers,* and *Recycling guide for fillers marketing in HDPE,* www.acor.org.au/materials.html

Environmental Code of Practice for Packaging (an attachment to the NPC), www.packagingcovenant.org.au (to be replaced by *Sustainable Packaging Guidelines* from 1 July 2010)

Envirowise (2008), *Packguide: a guide to packaging eco-design,* www.envirowise.gov.uk/uk/Our-Services/Publications/GG908-PackGuide-a-guide-to-packaging-eco-design.html

Recoup (2009), *Plastics packaging: recyclability by design,* www.recoup.org/business/default.asp?goto=eco_recbydesign

WRAP (undated), *A guide to evolving packaging design,* www.wrap.org.uk/retail/the_guide_to_evolving_packaging_design/

Organisations and web sites

Australian Council of Recyclers (ACOR) (to download copies of recycling guides for PET and HDPE and material specifications for PET, HDPE, LDPE and PVC): www.acor.org.au

National Packaging Covenant: www.packagingcovenant.org.au

PACIA (for information on life cycle management, D4S, sustainable recovery, plastics recycling and sustainability): www.pacia.org.au

Sustainability Victoria (for a range of D4S resources): www.sustainability.vic.gov.au

Sustainable Packaging Alliance (Packaging Impact Quick Evaluation Tool and other resources): www.sustainablepack.org

WRAP (on-line *Guide to evolving packaging design,* case studies and 'best in class' database): www.wrap.org.uk/retail

Footnotes

1 Packaging Council of Australia, http://pca.org.au/results08/apa/page.php?page=cartersustain.

2 Packaging Council of Australia, 2005, *Australian packaging: issues and trends,* p. 11.

3 Definitions based on *The National Packaging Covenant,* 2005, p. iv; and Saphire, D., 1994, *Delivering the goods: benefits of reusable shipping containers*, INFORM, New York.

4 Based on Envirowise, 2008, *Packguide: a guide to packaging eco-design,* p. 10.

5 The energy used to manufacture food packaging, for example, is approximately 10% of the energy used to supply the food to a consumer. See Incpen, 2009, *Table for one: the energy costs to feed one person,* www.incpen.org/pages/data/Table%20for%20One.pdf.

6 Toxics in Packaging Clearinghouse, www.toxicsinpackaging.org.

7 PACIA, www.pacia.org.au/Content/PIC.aspx.

8 Standards Australia, AS/NZS ISO 14021: 2000, *Environmental labels and declarations—Self-declared environmental claims* (Type II environmental labelling), p. 15.

9 Victorian Litter Action Alliance, www.litter.vic.gov.au/www/html/1320-tidyman-logo.asp.

10 Standards Australia, Ibid, p. 13.

11 National Packaging Covenant, www.packagingcovenant.org.au; NEPM, www.ephc.gov.au/taxonomy/term/48.

12 For more information on the ban on plastic bags see www.byobags.com.au; for CDL see www.zerowaste.sa.gov.au/Content/Uploaded/Generic/Documents/pdf/factsheets/container_deposit_legislation.pdf.

13 ACCC, www.accc.gov.au/content/index.phtml/itemId/815763.

14 VIP's PET bottle for Wolf Blass wine, *Packaging News,* June 2009, p. 10.