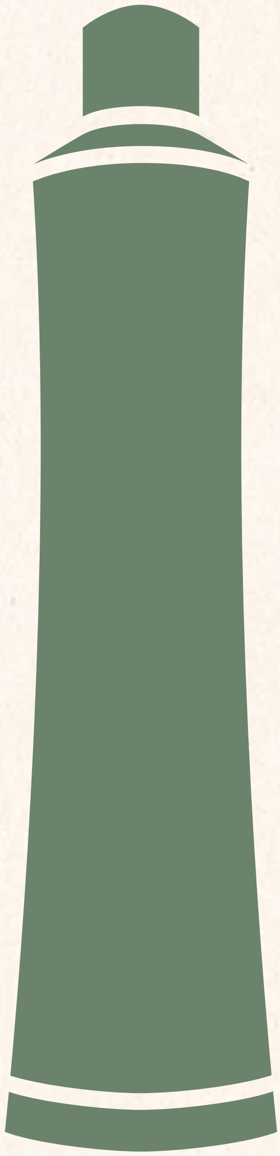
Design Smart Material Guide No.8

Australian Packaging Covenant

Composite Packaging



Australian Packaging Covenant

Contents

Purpose of this Guide

This Design Smart Material Guide for composite packaging is the eighth in a series of ten guides published by the Australian Packaging Covenant (APC).

It considers flexible and rigid composite multi-layer packaging, typically for residential consumer use, and manufactured from fossil hydrocarbon based plastic polymers, wood fibre and metals. For the purposes of this guide, composite packaging is defined as packaging that is made from two or more layers of different materials, which are bonded together and are not separable by consumers.

Examples of these types of packaging materials include: composite films (e.g. laminated and metallised plastic films); poly-laminated board grades (e.g. gable-top liquid paperboard, coffee cups); multi-laminated board grades (e.g. aseptic liquid paperboard); and composite cans.

The purpose of this guide is to help you improve the environmental performance of your packaging system, without compromising on cost or functionality. It provides a ‘checklist’ of sustainability issues to keep in mind when designing and/or specifying your next composite-based package. The guide will also support your packaging reviews against the Sustainable Packaging Guidelines (SPG), as required by the APC. To facilitate this, the design considerations are grouped under the four principles of the Guidelines.

The information contained in this guide is based on ‘life cycle thinking’, which considers the sustainability impacts of packaging throughout its supply chain, during use, and at end-of-life. It considers the impacts of the whole packaging system, including primary, secondary and tertiary packaging[1], as well as its performance in delivering the product to the consumer.

[1]Primary packaging contains the sales unit product (e.g. 125 g composite plastic pouch), secondary packaging contains the sales units (e.g. a corrugated board tray box, with shrink wrap holding 24 pouches), and tertiary packaging is the freight/distribution related packaging (e.g. a pallet, with pallet wrap and a heavy duty corrugated board pallet ‘slip’).

Purpose of this Guide

You are probably designing your packaging to fulfil a particular function, rather than an intrinsic need to use a composite in the primary packaging format. If this is the case, then we encourage you to read the first of the guides, which provides information on the comparative environmental and functional performance of the many different packaging material types that are available. Maybe there is another packaging format that will better fulfil your need to optimise cost, function, and environmental performance. Maybe now is the time to consider a bigger change?

A number of composite packaging types are not compatible with current recycling systems. The objective of designing these composite packaging formats for recycling is therefore less critical than it is for other forms of packaging that are accepted by kerbside recycling systems. The implications of this design consideration are addressed in this guide.

Composite packaging often has a weight advantage that provides significant life cycle benefits in terms of raw material inputs and distribution efficiencies. These benefits need to be optimised, with attention paid to lightweighting and efficiency at every stage of the life cycle. It is also important to understand and promote the environmental benefits of composite packaging to consumers, and ensure that they understand what to do with the packaging after use.

The development of this guide has largely relied on the sources listed in the Useful Further Reading section, as well as targeted consultation to confirm design aspects for the Australian context. The APC will endeavour to review the content of these guides on a regular basis to ensure currency and alignment to industry developments.

If you have any questions about theses guides, would like to make comments regarding the guidance provided, or just like to better understand sustainable packaging assessments in general, please contact the APC at apc@packagingcovenant.org.au.

The Life Cycle of Composite Packaging

Composite packaging takes many different forms, and its use is increasing (see Table 1). This is largely due to the many cost and efficiency benefits that can be achieved in the supply chain. Significant environmental benefits can also be achieved by switching from other packaging materials to composite materials.

Composite packaging formats are typically used where it is not possible to meet all the functional requirements using one material. Thin layers of different materials can be combined to fulfil design requirements that would otherwise be difficult or impossible to achieve using a single material. Even if the functional requirements could be achieved using a single material, much more packaging material might be required to achieve the required packaging performance.

The main functional characteristics that composites can provide are: excellent strength-to-weight ratio; good barrier properties (both gas and moisture); and self-sealing (i.e. the composite material can seal back onto itself). A composite packaging format is often used to achieve a combination of all three characteristics. Table 1 shows a listing of the main forms of composite packaging currently used in Australia.

As is apparent from Table 1, composite packaging usually has a plastic component. Plastic packaging in Australia is almost entirely made from hydrocarbons sourced from non-renewable sources (i.e. natural gas and crude oil). Most of the raw materials for polymers are co-products of petroleum refineries. For example, natural gas straight from the ground includes a mixture of gases including ethane, propane and butane. These are removed before the gas (mostly methane) is used in homes and industry for heating and cooking. Ethane and propane are used to make polyethylene and polypropylene respectively.

The hydrocarbons for plastics can also be sourced from renewable sources, such as plant sugars. However the focus of this guide is on packaging manufactured from non-renewable hydrocarbons. The ninth guide in this series considers packaging made from renewable sources; see the Degradable Plastic Packaging Guide for further information.

However, even if composite packaging is not recovered, it may generate less waste. Lightweight plastic composite laminates, particularly those that are less than 100 g/m^2 in thickness, are functional and resource-efficient (low weight) materials. The lightweighting of packaging, particularly with the significant gains that can be made by shifting to composite packaging formats, is an effective approach to reducing the environmental impacts of packaging.

While composite packaging formats are generally not cost effective to recycle in Australia at the present time, this is not always a critical disadvantage from a life cycle perspective. Liquid paperboard packaging is generally recovered through kerbside collection services and sent to a pulp mill to recover the fibre component. However, the fibre yield is often lower than for other forms of fibre-based packaging, due to the use of the wet-strength board for milk cartons and additional layers of polyethylene and aluminium in aseptic packaging. The plastic and aluminium layers as well as any non-recoverable fibre are often disposed to landfill by the pulp mill operator, or might be burnt for energy recovery. New technologies to recover metallised films and other multi-layer materials are under development overseas and may provide recovery solutions in the longer term.

The Life Cycle of Composite Packaging

Table 1

Types and applications of composite packaging

Type of Composite Packaging Material[1]	Examples of Packaging Applications	Typical Structure[2] (outside to inside)	Typical Weight (grams/m²)
Poly-Laminated Board (Liquid Paperboard)	Fresh milk cartons and coffee cups	PE / ink / cartonboard / PE The cartonboard makes up around 85% of the weight of the composite material. The wood fibre in LPB is usually 100% from virgin sources.	250-500
Multi-Laminated Board (Aseptic Liquid Paperboard)	Long-life (shelf-stable) milk cartons	PE / ink / cartonboard / PE / aluminium foil / PE The cartonboard makes up about 75% of the weight of the packaging, and the aluminium around 5%. The wood fibre in LPB is usually 100% from virgin sources.	250-500
OPET/PE Films	Cheese wrap	OPET/ ink / LDPE	70
OPET/Al/PE Films	Pet food, baby food, coffee and other food powders	OPET / ink / aluminium foil / PE	100
OPET Films - Metallised	Lids for yoghurt tubs	Ink / paper / aluminium metallisation / OPET / lacquer	70
OPP Films - Heat Sealable	Baked goods wrap (on a tray)	PE-PP copolymer / PP / PE-PP copolymer	25
OPP Films - Metallised	Potato chip bags, wrapping films, labels	Copolymer OPP / OPP / copolymer OPP / ink / aluminium metallisation / PE-PP copolymer / OPP / PE-PP copolymer	35
OPP/PVDC Films	Biscuit roll wrap	PVDC / ink / OPP / PVDC	35
PP Cups - Retortable	Fruit cups	Cup – PP / EVOH / PP Seal – OPET / silicon oxide / OPA / PE	80 (seal)
Aluminium and Paper Wraps	Butter	Aluminium foil / wax / paper	80
Multi-Layer Bottles	Squeezable bottles for sauces and honey	Bottle – PET / EVOH / PET Seal – OPET / aluminium foil / PE	90 (seal)

1. EVOH–ethylene vinyl alcohol / HDPE–high density polyethylene / LDPE–low density polyethylene / LPB–liquid paperboard / OPA–orientated polyamide / OPET–orientated polyethylene terephthalate / OPP–orientated polypropylene / PE–polyethylene / PP–polypropylene / PVDC–polyvinylidene chloride.
2. Adhesive layers are not stated.

Understanding what makes any packaging type 'recyclable' helps to inform the packaging design process. For a packaging format to be recyclable there have to be systems in place for collection, sorting, and reprocessing, and markets available for the recovered recyclate. These systems are in place for most post-consumer rigid plastic packaging, but not (with some exceptions) for composite packaging.

The Life Cycle of Composite Packaging

Figure 1

Life cycle of composite packaging

Adapted from diagrams developed by GreenBlue (2009)

The Life Cycle of Composite Packaging

In favour

Life Cycle Related Considerations in Favour of Composite Packaging

- Composite materials generally have a high strength-to-weight ratio, and can therefore be used to manufacture strong and efficient packaging.
- High barrier (to moisture, oxygen, microbes and light) composite materials can offer very good shelf stability, reducing food wastage and associated environmental impacts.
- In general, life cycle studies comparing the use of composite containers, compared with rigid plastics, fibre, glass or metal alternatives, have found that the composite material packs perform as well or better across most areas of environmental impact.
- Composite packaging can use a lot less material than alternative materials, resulting in significant energy and water savings in production.
- Composite packaging is lightweight and saves energy in transport. Empty composite packaging can often be transported to fillers with excellent space efficiencies.
- Some composite packaging formats are shelf-stable (e.g. aseptic liquid paperboard), lowering wastage and refrigeration requirements.
- Composite packaging is versatile and provides reasonable product protection.
- There is a low risk of food contamination from the packaging.
- The plastic component of composite packaging, if disposed to landfill, will not decompose. This results in the continuing long-term sequestration (storage) of the fossil carbon in the plastic , rather than this being released to the atmosphere as a greenhouse gas.
- Very thin layers of aluminium foil may be sufficient to achieve the required packaging functionality. However, any aluminium layer less than 0.2 mm (200 micrometres) in thickness is probably not recoverable at end-of-life (see below under ‘considerations against’). Aluminium beverage can walls and lids are typically around 0.25 mm thick.
- Aluminium layers manufactured using vapour deposition on a plastic substrate are ultra-thin (40–100 nanometres). This type of aluminium layer provides the required barrier properties, and while the aluminium is not recoverable, it is so thin as to contain a trivial amount of aluminium. A square kilometre of 70 nm-thick aluminium would weigh 190 kg.

The Life Cycle of Composite Packaging

Against

Life Cycle Related Considerations Against Composite Packaging

- The plastics and aluminium components of composite packaging are generally made from non-renewable gas, oil and bauxite resources.
- The extraction of non-renewable hydrocarbons results in the direct emission of greenhouse gases, and is a significant source of risk for pollution of the local environment (e.g. from oil spills).
- Virgin wood fibre and aluminium production are energy and chemicals-intensive.
- Most forms of composite packaging are not collected by kerbside collection systems in Australia.
- Composite film packaging is generally more difficult to sort from commingled kerbside recycling streams at Materials Recovery Facilities (MRFs).
- Composite packaging is more challenging to recover because it often involves multiple polymer layers, fibre layers and/or a layer of aluminium, which are difficult to separate.
- Composite packaging materials incorporating aluminium (e.g. aseptic liquid paperboard) are not fully recyclable in Australia. A proportion of the wood fibre (but not the aluminium or plastic components) will be recovered at some pulp mills, however the level of this recovery is unknown and probably fairly low.
- The use of recycled content in composite packaging materials is generally not possible, due to the high performance requirements and its typical use in food contact applications. In some applications, recycled content can be used in the layers that are not in contact with the product.
- Most forms of composite packaging are not biodegradable, increasing the hazard that littered items can present to wildlife, and litter-related amenity issues (see the ninth guide on degradable, biodegradable and compostable plastic packaging for more detail on polymers that will biodegrade in specific environments).

Design Considerations for Composite Packaging

Packaging design should be guided by the resource efficiency design hierarchy[1].

The hierarchy of preferred packaging design changes is: avoid, minimise, reuse, recycle, recover (energy) and dispose.

The robustness of this general hierarchy is backed by a very significant body of evidence, based on packaging life cycle assessments (LCAs).

Embedded across the resource efficiency design hierarchy are the requirements to maintain or improve the packaging system functionality (fitness for purpose), and to minimise product losses. The environmental impacts associated with the packaged product are usually much greater than the packaging itself. Don't compromise functional performance (e.g. through down-gauging) to reduce the environmental impacts of the packaging, if it could lead to greater overall environmental impacts due to product loss and wastage.

More specifically, the key design aspects to keep in mind to minimise the environmental impacts of composite packaging are:

- Lightweight as much as possible to minimise material consumption.
- Minimise manufacturing inputs (e.g. energy and water).
- Specify inks that generate minimal volatile organic compound (VOC) emissions.
- Use recycled content if possible.
- Source sustainable inputs (e.g. fibre) from responsible suppliers.
- Design for the effective reprocessing of your packaging, even if recovery options are currently limited. For composite materials this could include reducing the number of layers of material, or even shifting to a mono-material packaging. Minimise the use of resin additives, and carefully consider your use of caps, seals, inks, dyes and labels. Design for ease of polymer separation during reprocessing.

As with all other packaging materials, composite packaging systems have specific design constraints, which may limit the application of the resource efficiency design hierarchy. With this in mind, we have outlined the general design considerations for composite packaging in Figure 2. During material selection and packaging system design all of the aspects in Figure 2 should be considered.

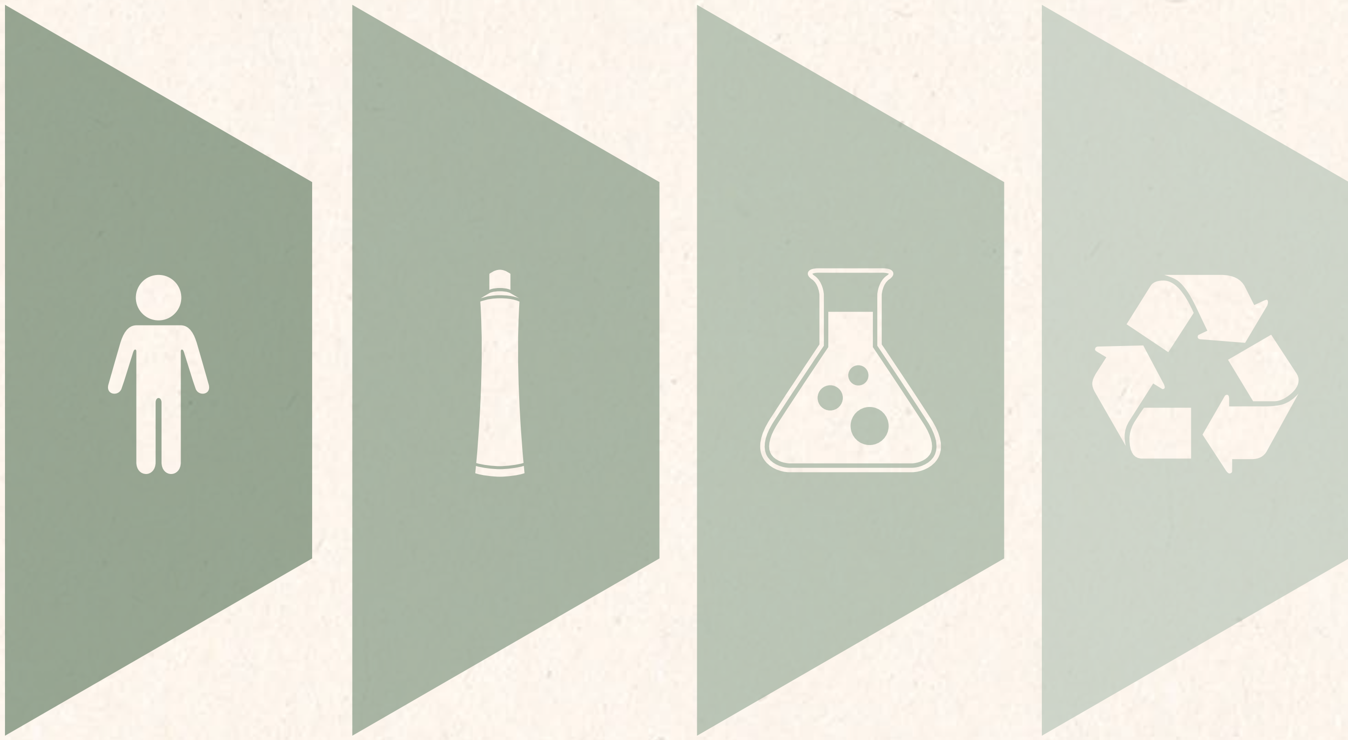
Each of these design considerations is then discussed in more detail in Table 2.

[1]The resource efficiency design hierarchy is also often referred to as the waste hierarchy.

Design Considerations for Composite Packaging

Figure 2

Summary of design considerations for composite packaging



Design to be fit-for-purpose
SPG principle 1

Design to:

- Improve accessibility
- Minimise product waste by consumers
- Manage the trade-offs between primary, secondary and tertiary packaging

Design for resource efficiency
SPG principle 2

Design to:

- Minimise the primary packaging
- Minimise the secondary packaging
- Maximise transport efficiencies
- Minimise the manufacturing inputs of production processes
- Use reusable/ returnable secondary packaging
- Reduce consumption related impacts
- Recover filling line packaging losses

Design with low-impact materials
SPG principle 3

Design to:

- Source sustainable fibre
- Maximise recycled content in secondary packaging
- Minimise the use of problematic chemicals during packaging manufacture
- Maximise recycled content in primary packaging

Design for resource recovery
SPG principle 4

Design to/for:

- Increase recovery
- Maximise the value of the recovered recyclate
- Improve the recyclability of multi-laminate/poly-laminate cartons, and polymer coated board grades
- Elimate or minimise the use of metal layers or components
- Provide clear consumer information

Design Considerations for Composite Packaging

Table 2

SPG Principle	Design to	Design Considerations	Life Cycle Importance
1 - Design to be Fit-for-Purpose	Improve accessibility	If using caps, closures or seals with composite packaging, check the required removal force. The force required to pull or puncture the seal should not exceed 22 newtons. Avoid seals that require a tool to puncture. If composite packaging is intended to be torn open, then provide a perforated strip, a notch, a starter slit, or serrated edges. The force required to tear the packaging open should not exceed 22 newtons. When using a foil seal pull tab, increase the coefficient of friction by coating the tab so that extensive pinching is not required, and increase the size of the tab to accommodate a pinch. Place directions for opening the packaging directly on the packaging in a clear, easy-to-comprehend format. Zip tracks on resealable packaging can be difficult to re-seal properly. These can be improved by using the right zip for the right package, and using a plastic nubbin (zip fastener) that is big enough to grip. Make heat sealed strips, and press-and-seal strips, easier to pull apart by leaving enough room for fingers to grip the two edges, both for opening and closing. Check Arthritis Australia's Food Packaging Design Accessibility Guidelines (see Useful Further Reading list) for more suggestions to improve the accessibility of your packaging.	HIGH
	Minimise product waste by consumers	Ensure that the contents can be fully dispensed, e.g. by avoiding designs that make it difficult for consumers to remove the last bit of product. Product waste left behind in the packaging may increase reprocessing costs (if the packaging is recyclable), and decrease the value of the recovered recyclate. The loss of your product as waste is also the loss of a valuable resource with a potentially significant environmental impact. Another approach to consider is modifying the flow characteristics of your product, so it is more easily dispensed. Obviously, there is a trade-off here, as concentrating a product (and potentially increasing its viscosity) leads to a reduction in the packaging requirement. Speak to your suppliers about balancing viscosity and product concentration.	MEDIUM
	Manage the trade-offs between primary, secondary and tertiary packaging	Consider possibilities for minimising the tertiary packaging components that are required to secure loaded pallets, which include the use of: strapping, down-gauged and perforated stretch films, sleeves, 'lock-'n-pop' low-residue adhesives, returnable plastic crates that lock into place on pallets with minimal strapping, or pallet boxes.	MEDIUM

Design Considerations for Composite Packaging

2 - Design for Resource Efficiency	Minimise the primary packaging	Computerised design techniques, such as Finite Element Analysis, can help minimise packaging material use. In addition, technologies are always improving. Speak to your suppliers about different design and manufacturing techniques that can reduce material usage. Composite plastic films are often used to improve control of (and usually reduce) moisture and gas transfer rates through the packaging material. An important aspect of this is ensuring that seals (typically at both ends and a long seal along the length of the packaging) are well-formed. This is important to ensure that the packaging is fit for purpose and packaged food lasts well. Ask your supplier if there are any opportunities to reduce your packaging by minimising seal overlap, as long as this does not impact on the effectiveness of the seal. Avoid the use of layers that aren't absolutely necessary, and avoid over-specification of packaging performance. Investigate whether there are simpler composite materials available that will fulfil your functional requirement. Reduce the size of the packaging by designing to minimise head space and voids, and design using dimensionally efficient shapes. Consider doing some 'back of the envelope' calculations on your product for packaging weight and volumetric ratios as part of your packaging system design process. Pre-settling or vacuum packing loose fill product is not feasible for many less dense products. However, consider if one of these techniques is viable for your product. Reducing the product volume reduces the primary, secondary and tertiary packaging requirement, and also reduces the transport requirements. The movement towards concentrating products (e.g. double- or triple-concentrated laundry detergents) is now well established in Australia. Concentrated products require less primary, secondary and tertiary packaging, and are also more efficient to transport. Is reformulating your product to reduce its water content (or volume in general) a viable possibility? Consider using in-store shelf-ready packaging more effectively for product communication rather than relying on additional primary packaging components. The secondary packaging can incorporate elements such as external and internal printing to aid brand recognition, while controlling and presenting products, e.g. in flexible composite packaging formats, consistently. Potentially these types of changes can also lead to less in-store labour. More packaging is often used to signal a premium product. Consider alternative approaches to signal product quality to consumers through reduced printing and primary packaging. For example consider the use of shelf-ready secondary packaging that allows the reduction or elimination of primary packaging.	HIGH

Design Considerations for Composite Packaging

2 - Design for Resource Efficiency		Composite 'multi-laminate' board grades (aseptic liquid paperboard), which incorporate a layer of aluminium foil, are not fully recyclable in Australia (i.e. they may be collected for recycling but only a proportion of the wood fibre is ultimately recovered at the pulp mill), and the aluminium layer will definitely not be recovered. Packages made from this material are used to hold products such as long-life milk, stocks and fruit juices. They provide excellent barrier properties, shelf stability, strength and low weight. A typical composition of this laminated material is 70–75% wood fibre, 20% LDPE film(s) and 4% aluminium foil. Consider if the barrier/product protection functionality provided by the aluminium layer is necessary for your product, as liquid paperboard grades (poly-laminated board) without the aluminium layer are available. Consider if a recoverable mono material primary packaging material type is available to fulfil the functional requirements for your application. Another option is to shift from aluminium foil to a metallised film. These have an aluminium layer manufactured using vapour deposition of aluminium onto another substrate (usually a plastic film), where the aluminium layer is ultra-thin (40–100 nm) but can be functionally equivalent to much thicker aluminium foil. From an overall life cycle perspective, the use of the metallised plastic has a much lower impact than aluminium foil. Ask your suppliers about the availability of metallised composite materials that will fulfil your functional requirements.	
	Minimise the secondary packaging	Optimise your use of corrugated board in secondary packaging by minimising flap overlaps (even to the point that the box contents are visible). Also consider moving the flaps to the smallest end of the box (so there is less overlapping flap material). Discuss the possible options with your supplier and/or converter. You might be using a double-walled corrugated container (with two corrugated medium layers) to fulfil a structural strength requirement. Consider if adequate strength can be achieved with a single-walled corrugated container through the use of thicker gauge liners, while still achieving a reduction in overall weight. Ask your supplier to assist with identifying the lightest weight corrugated board that will fulfil your functional requirement. Shelf-ready packaging is becoming an important supply chain value-add for many food and grocery items, and this shift may increase the packaging-to-product ratio. When moving to shelf-ready packaging, look for opportunities to minimise material use. Down-gauge secondary packaging as much as possible, while ensuring that the integrity of the primary pack is not compromised. The exception to this is if you are considering moving to a higher level of recycled content in the fibre based secondary packaging, in which case a degree of 'up-gauging' could well be justified. See the second guide in this series (Fibre-Based Packaging), for more details on optimising the environmental performance of corrugated board-based secondary packaging.	HIGH
	Maximise transport efficiencies	Have a look at your palletisation (volumetric) efficiencies; improving these can significantly reduce the costs associated with product storage and distribution.	HIGH

Design Considerations for Composite Packaging

2 - Design for Resource Efficiency	Minimise the manufacturing inputs of production processes	Electricity is usually the primary energy input during the manufacture of composite packaging, used both for powering equipment and for generating the heat needed for forming the packaging. Ask your suppliers about their energy procurement practices, in particular for electricity. Do they source a proportion of their electricity from GreenPower™ accredited sources? What are the measures they have in place to improve energy efficiency? Do they purchase any greenhouse gas offsets? Source your polymers from suppliers with a documented environmental management system and a strong commitment to best practice, for example, check if your supplier is a signatory to PACIA's Sustainability Leadership Framework.	MEDIUM
	Use reusable/ returnable secondary packaging	Returnable plastic crates/trays (RPCs) that are collapsible or nesting are now seeing much broader use in the market, particularly by the major supermarket chains. The life cycle environmental and cost benefits of using returnable plastic crate systems, instead of corrugated boxes, are significant. Supply chain product losses are also reported to be significantly lower when using returnable plastic crate systems. However this currently relates more to fresh foods, such as fruit and vegetables, than more robust products commonly found in composite packaging. The market is moving in this direction, so consider if your product could be supplied in RPCs. Reusable packaging can be particularly suitable for short distribution chains, loose or manually packed products, easily damaged high value products, and large volume fast moving products.	MEDIUM
	Reduce consumption related impacts	If your product doesn't require refrigeration, make sure that this is prominently communicated on the label, to avoid consumers unnecessarily refrigerating the product. This can be a major advantage for self-stable composite packaging.	MEDIUM
	Recover filling line packaging losses	While composite packaging losses in the filling line will be low, confirm with line operators that they have an appropriate recycling collection system in place.	LOW

3 - Design with Low-Impact Materials	Source sustainable fibre	Ask your supplier about the source of all virgin wood fibre to ensure that it is from a sustainable source. Look for credible, third-party certification of claims. Numerous independent certification schemes exist, of which the Forest Stewardship Council (FSC) is one of the best known, independent and most reputable.	HIGH
	Maximise recycled content in secondary packaging	Specify the highest possible level of post-consumer content in corrugated board or polyethylene over-wraps and shelf-ready packaging, while maintaining the required functional and strength performance of the secondary packaging.	MEDIUM

Design Considerations for Composite Packaging

3 - Design with Low-Impact Materials	Minimise the use of problematic chemicals during packaging manufacture	Printing processes for composite packaging often involve the use of high VOC (volatile organic compound) chemicals, particularly in the solvents. These chemicals can be locally toxic to human health (e.g. to the shop-floor workers) and the environment, and their use requires the operation of significant (and expensive) pollution control measures, such as gas-fired after-burners. Discuss with your packaging material supplier whether alternative low-VOC inks and lacquers are available that will fulfil your requirement. Water-based inks and ultra-violet curable inks have the lowest VOC emissions. This type of change may reduce emission management-related costs, improve the health of the local environment, and will assist your supplier in maintaining a healthy work environment. The manufacture of plastic film laminates, including those incorporating an aluminium layer, can utilise a number of different co-extrusion or lamination processes for forming the material. In particular, many different types of adhesives (often based on polyurethane chemistries) and coatings (e.g. protective coatings, seal related coatings and primers) can be used in the manufacture of composite film laminates. Speak to your supplier about the specific adhesive and coating systems used for your packaging and check whether low- or no-VOC types are available (e.g. solventless adhesives), if not already in use. In particular, avoid the use of toluene as a solvent in adhesives and coatings. Also consider checking whether functionally equivalent laminates are available that avoid the use of adhesives or reduce the number of coatings that are required.	MEDIUM
	Maximise recycled content in primary packaging	Ask your packaging suppliers about the potential to incorporate some post-consumer recycled material in your packaging.	MEDIUM

4 - Design for Resource Recovery	Increase recovery	Identify the most viable recovery option at the present time, and design your packaging accordingly. Check whether there is an option to recover your product (e.g. through a retail drop-off scheme), and design your packaging to be compatible with this system. For example, if you sell a consumer food product in a bag or pouch, which could be recovered through the national retail drop-off scheme for plastic films, try to avoid or minimise layers of different polymers and aluminium. Carefully consider your use of pigments, inks and labels. Multi-layer films with aluminium foil or paper components can be problematic in plastics recycling, and are very unlikely to be recovered. As much as possible, metal or paper components should be avoided or minimised. Avoid using a combination of different polymer types, as this inhibits recyclability. New barrier films are being developed with only one material, or primarily one material, to improve recyclability.	MEDIUM

Design Considerations for Composite Packaging

4 - Design for Resource Recovery			
	Maximise the value of the recovered recyclate	Clear, unprinted films produce higher value recyclate than coloured films. Avoid the use of black films, which cannot be identified by optical and near infra-red (NIR) sorting systems. Minimise the amount of printing on your packaging. Printing inks generate VOCs during the recycling process and reduce the quality of the recycled resin. Avoid polyvinylidene chloride (PVDC) in your barrier film (there are alternatives, such as ethylene vinyl alcohol (EVOH)). PVDC degrades at temperatures very near to typical plastics reprocessing temperatures and turns the recyclate brown. Avoid or minimise the use of 'fillers' (e.g. calcium carbonate, talc, and titanium dioxide) that change the density of the plastic. Fillers cause reprocessing issues and lower the value of the recovered recyclate.	MEDIUM
	Improve the recyclability of multi-laminate/ poly-laminate cartons, and polymer coated board grades	Laminated boards are typically made from a high grade 100% virgin fibre layer, as well as layers of other materials (typically polyethylene and/or aluminium), and are commonly called liquid paperboard (LPB). LPB-based cartons offer many advantages including barrier properties, shelf stability, cube utilisation, and relatively low weight. The two main types are 'multi-laminate' cartons (aseptic LPB) with an aluminium and polyethylene layers, and 'poly-laminate' cartons (gable-top LPB) with a polyethylene layer on the inside only. Multi-laminate board is used for shelf-stable liquid products such as long-life milk, stocks and fruit juices, and it is an excellent material in terms of barrier properties, shelf stability, strength and low weight. A typical structure would be (outside to inside): polyethylene (15 g/m^2), printed layer (2–3 g/m^2), cartonboard (230–400 g/m^2), polyethylene (10–30 g/m^2), aluminium foil (16–24 g/m^2), bonding layer (2–8 g/m^2), and polyethylene (30–60 g/m^2). By weight, 75% of the board is wood fibre, and (unlike poly-laminate board) usually does not have any wet-strength resin incorporated into the fibre, which would provide additional moisture resistance. Poly-laminated board (gable-top LPB) is used for liquid products where an aseptic seal is not required, such as chilled fresh milk and juice cartons, and has many of the same benefits as multi-laminate board. This board grade generally has only one layer of polyethylene (on the inside), no aluminium layer, and the fibre has a wet-strength resin incorporated into it to provide moisture resistance. Both carton types are likely to break-up (to a degree) during pulping. Due to the wet-strength resin added to the poly-laminated board, this fibre is less likely to fully pulp. The polyethylene and aluminium layers in multi-laminate board will also impede the pulping of aseptic LPB cartons, and will not be recovered during recycling, except potentially to be burnt for energy recovery at some pulp mills. Ask your supplier about the recoverability of the fibre in your laminated board. If in doubt, ask them for third-party certified information on the pulpability (fibre yield) of the material and the functional performance of paper made from the recovered fibre. Consider whether there is an alternative packaging format that meets your requirements and is easier to recycle (e.g. one made from only one material).	MEDIUM

Design Considerations for Composite Packaging

4 - Design for Resource Recovery	Eliminate or minimise the use of metal layers or components	As neither aluminium foil nor aluminium metallised films are recoverable within current systems, from an overall life cycle perspective, the use of the metallised plastic films will probably result in the lowest life cycle impact. Avoid the use of composite bi-metal beverage cans which have steel bodies with aluminium ends (which are currently rare in Australia). Electro-magnets at Materials Recovery Facilities (MRFs) will often divert these types of composite metal packaging into the steel can stream early in the sorting process and the aluminium components will be lost during steel smelting. Avoid other types of composite cans (e.g. rigid composite cans with a top and bottom made from plastic, steel or aluminium, and a cylindrical wall made from coated fibreboard). These will also often end up in the steel can stream at the MRF and only the steel component will be recovered. If they must be used, provide instructions for consumers on safe disassembly and disposal (see below).	MEDIUM
	Provide clear consumer information	If a collection and recycling process for your packaging is not available to a reasonable proportion of consumers, avoid printing the PIC (Plastics Identification Code) in a prominent location on the pack. This may mislead consumers by indicating that the packaging is recyclable. Provide clear advice to consumers on how to recycle or dispose of the packaging. Composite packaging is rarely recyclable, so consider labelling the packaging clearly as 'Not currently recyclable', to assist in its necessary disposal to landfill. Some forms of composite packaging (e.g. rigid composite cans with a top and bottom made from plastic, steel or aluminium, and a cylindrical wall made from coated fibreboard) could potentially be recovered through current recycling systems, if consumers are given clear instructions on how to disassemble the packaging and divert each material component appropriately. Consider providing instructions on the label guiding the disassembly of these types of composite packaging, ensuring that the recommended practices are safe (e.g. do not require use of a knife). See the Introductory Guide for more on labelling in general.	MEDIUM

Design Example

This design example illustrates some of the sustainability design aspects that could be considered during a packaging development or review. The brief is for a more sustainable and recyclable takeaway coffee cup. The conventional design is a virgin fibre cup with a water-resistant polyethylene (PE) coating (around 5% by weight) and a moulded polystyrene (PS) cap.

Sustainable design considerations

Design for recycling

Design for recycling is appropriate if there is a collection and recycling system available, particularly where paper and cardboard are already collected. Coffee cups are difficult to recycle because of the plastic coating, so if this is your preferred strategy you will need to be proactive:

- Collaborate with cup manufacturers, recyclers and other retailers to develop an effective recycling program[1]
- Talk to suppliers about the availability of a plastic coating that can be separated from fibre during the paper pulping process
- Reduce the thickness of the coating – the less coating there is, the easier it is to recycle
- Avoid or minimise printing on the cup – inks are a contaminant in the recycling process

Choose a lid that is larger than 50mm diameter and rigid enough to hold form throughout the recovery process. Black should be avoided.

Design for composting

Design for composting is appropriate if there is a collection and recovery system available, particularly where food waste is already collected. This is particularly relevant for institutions, food service businesses and public events. If this is your preferred recovery strategy:

- Replace the conventional polyethylene coating with one that has been certified 'compostable'[2]
- Specify a compostable polymer for the cap
- Avoid or minimise printing and use only vegetable-based inks
- Provide a brief message for consumers, e.g. 'please dispose of this in the organic waste bin'

Consumer comfort and safety

- The cup needs sufficient insulation to prevent consumers burning their fingers. Use a ribbed board rather than a thicker gauge to provide more insulation
- The lid needs to be secure enough to prevent spills that could cause burns, e.g. in a moving car

[1]Starbucks is working with its supply chain and competitors to find ways of recycling their paper coffee cups (www.starbucks.com/responsibility/environment/recycling)
[2]For example, BioCups (https://biopak.com.au/products.php?id=23&gclid=CILL4sGkxbACFQ4rpAodGkvYpg) are lined with compostable poly lactic acid (PLA).

Design Example

Wood fibre source
• Investigate the potential to use some post-consumer or post-industrial recycled fibre in the coffee cup, for example, in the insulating layer that doesn't come into contact with the coffee or the consumer.
• Ensure that fibre content is certified to the Forest Stewardship Council standard, or similar.
Consumer labelling
• Do not use the word 'recyclable' or the Mobius loop recycling symbol on the coffee cup unless you know that most consumers have access to a collection and recycling service.
• If the lid is considered recyclable, mould the Plastics Identification Code for PS (number 6) onto the cap.
• If appropriate, provide information on the coffee cup about the origin of ethically and sustainably sourced coffee beans and milk.

More innovative ideas that could be explored

- Provide customers with a reusable cup - there are many great designs on the market. The biggest challenge is to change consumer behaviour, for example by providing incentives that encourage customers to bring in a reusable cup. See an award-winning suggestion to Starbucks.

Useful Further Reading

Reference	What is it?
APC, 2010. Sustainable Packaging Guidelines, Australian Packaging Covenant. 30 pages.	The SPG is the key document for APC signatories and others to use in framing APC-compliant packaging reviews. The objectives of these reviews are to optimise resources and reduce environmental impact, without compromising product quality and safety. Free download from: www.packagingcovenant.org.au
Arthritis Australia, 2012. Food packaging design accessibility guidelines. 31 pages.	This document provides more detailed guidance on accessibility principles and strategies to improve accessibility of food packaging; prepared in conjunction with NSW Health. For a complimentary copy of the Food Packaging Accessibility Guidelines and several other packaging design reports contact Arthritis Australia at: design@arthritisaustralia.com.au
ILSI (European Branch), 2011. Packaging Materials 9: Multi-layer Packaging for Food and Beverages. International Life Sciences Institute (ILSI), Brussels. 48 pages.	This is a fairly technical report that provides an excellent overview on the types and properties of composite packaging materials, manufacturing processes, and various design considerations. The report also provides detail on environmental, regulatory (for Europe), safety and toxicology aspects for composite packaging materials. Free download from: www.ilsi.org
PACIA, 2010. Quickstart Issue 11: Sustainable design principles for packaging. Plastics and Chemicals Industries Association (PACIA), Melbourne. 5 pages.	This guidance document provides an excellent overview of sustainable packaging design, with a focus on plastic packaging. As with this guide, the Quickstart is aligned with the four principles of the APC's Sustainable Packaging Guidelines (fitness for purpose, resource efficiency, low-impact materials use and resource recovery). The document also provides an overview on how to minimise any drawbacks associated with using recycled plastics. Free download from: www.pacia.org.au/programs/quickstartpublications
Verghese, K., Lewis, H. & Fitzpatrick, L., 2012. Packaging for Sustainability. 1st ed. Boston: Springer. 384 pages.	This life cycle thinking-based reference book provides extensive detail on just about every aspect of sustainable packaging design. Beyond design, it also contains detailed information on marketing, regulatory and labelling aspects. Order from: www.springer.com/engineering/production+engineering/book/978-0-85729-987-1

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