Sustainable Packaging Redefined

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1. Introduction

Sustainability is a complex concept and one which is very much open to interpretation. While we are reminded almost daily about the environmental damage caused by human activities, including climate change, land degradation and declining water availability and quality, uncertainties remain about the best way to respond at a personal, corporate and government level.

Questions about sustainability and corporate social responsibility are being seriously considered and actioned by many companies around the world. Companies are grappling with identification of the major environmental impacts of their activities and how to address these through changes in manufacturing, design, logistics, marketing and business structures and relationships.

The packaging industry in particular has been under intense pressure for decades to reduce packaging waste and over-packaging and, improve recyclability. However, there is concern that these goals are being pursued without considering the complex role of packaging and the systems that supply chains are a part of. Consequently it is often unclear whether isolated decisions provide a net overall improvement in environmental performance.

At the same time social pressures require that environmental objectives do not compromise economic growth, jobs and standards of living. These in turn require that businesses must integrate environmental objectives with other business drivers relating to cost, market share and customer expectations and make these decisions within the context of their position in supply chains.

Several organisations have tried to define 'sustainable packaging' by establishing sets of principles or strategies which could guide decision-making, including the Sustainable Packaging Alliance (SPA) in Australia and the Sustainable Packaging Coalition (SPC) in the United States. The language of sustainable packaging is also being adopted by some industry associations and companies, either as a repackaging of environmental policies in the language of sustainability, as a marketing strategy in response to social pressures or, as a genuine attempt to grapple with the commercial, social and environmental issues associated with packaging. New tools have also been developed to evaluate the lifecycle environmental impacts of packaging, while the global warming debate has encouraged some companies to focus on the 'carbon footprint' of packaging as a relevant and simple way of communicating environmental impact.

This paper critically reviews SPA's definition in the context of these developments and suggests a number of changes. The original research which was undertaken between 2002 and 2005 is presented in section two, followed by a review of other initiatives in the field in section three. Links, synergies and gaps are identified in section four and these are used to build a revised definition of sustainable packaging. Finally, the paper concludes with a brief discussion about the implications of this work for corporate practice (section five) and future research (section six).

2. SPA's first definition of sustainable packaging

2.1 Background

SPA was formed in Australia in 2002 by Victoria University of Technology, through its Packaging and Polymer Research Unit, RMIT University through its Centre for Design and Birubi Innovation Pty Ltd. Its aim is to facilitate continuous improvement in the environmental performance and sustainability of packaging through research, industry engagement and the development of practical tools and strategies for the packaging industry[1].

The first task undertaken by SPA was to investigate the meaning of 'sustainable packaging' based on a literature review and a survey of key stakeholders. It was important to learn from theoretical discussions about sustainability and sustainable development and to apply this knowledge to the development of a workable definition of sustainable packaging.

The feedback from stakeholders highlighted the complexities involved in packaging and the need to balance social, environmental and commercial drivers, for example (Lewis, 2003):

> *In Australia, progress is being made towards more sustainable packaging but more can and needs to be done around reduce, reuse, redesign and recycle via a cooperative supply chain approach. Packaging needs to be seen as an integral part of the product and as such more also needs to be done about educating the consumer about responsible behaviour regarding the use and disposal of the packaged product. So the sustainable packaging journey needs ongoing improved performance and attitudes by the producers (industry) and the users (community).*
> Packaging manufacturer

> *The unsustainable use of packaging is part of a wider phenomenon of unsustainable consumption. By itself, it is not the core problem, but it is the most visible symptom. However, it is itself a contribution to the phenomenon of unsustainable consumption. Plastic bags, wraps, EPS etc are litter-ugly and are marine pollutants. Paper bags and wrappers are aesthetically pleasing but (particularly) harmful in manufacture. At the same time, packaging is a great protector of agricultural and manufactured products and thus a great saver of scarce resources. A society's self-management of packaging is part of the bigger problem of its self-management of consumption.*
> Packaging industry consultant

> *In an ideal world packaging systems should seamlessly fulfill the expectations of all stakeholders involved in the supply chain as well as government and community stakeholders. It should be able to support business growth, to meet user/consumer values and expectations (both in terms of supplying expected quality of product as well as convenience in product use and discarding of packaging) and to minimally impact on the environment.*
> Academic

A fundamental problem with this type of work is that it implies that a single definition of sustainable packaging can be developed. In reality, the environmental impacts of a particular packaging system will depend heavily on specific issues relating to its purpose, the length and nature of the supply chain, and recovery, re-use and disposal options. The interaction between environmental, commercial and social performance requirements also needs to be considered on a case-by-case basis. However, the aim was always to develop a set of principles which could guide decision-making rather than providing a 'black and white' description of the ideal package.

[1] http://www.sustainablepack.org/default.aspx, accessed 8 November 2007.

SPA's research was based on stakeholder engagement and consultation and was therefore iterative. The original work was disseminated, discussed at industry forums, revised and published in a number of different forms:

- a background paper called 'Towards sustainable packaging' was prepared as the basis for discussion with industry and government stakeholders in October 2002 (SPA, 2002). This paper identified the need for research which would establish consensus on the principles and strategies which should be followed to achieve 'sustainable packaging systems';
- a survey of 30 key stakeholders was undertaken in 2003 and the results were presented in a paper entitled 'Defining packaging sustainability' to an International Solid Waste Association (ISWA) conference in Melbourne in November of that year (Lewis, 2003);
- this research was used to shape the original SPA definition of sustainable packaging, which was published on SPA's web site in 2004 (SPA, 2005);
- a more detailed paper on the research was later published in a peer-reviewed journal, *Environmental Science & Policy* (Lewis, 2005); and
- a series of 'sustainable packaging indicators', which were developed in a study of industrial packaging supply chains (James *et al.*, 2005), and the definition were discussed at an industry Round Table run by SPA in June 2005.

The basic principles and indicators are presented in the following section.

3.1 Sustainable packaging definition and indicators

The research identified several important issues which need to be considered in any evaluation of packaging sustainability, particularly in relation to scope:

- it needs to consider the entire lifecycle of the package from raw materials through to ultimate disposal to avoid problems being transferred from one part of the lifecycle to another;
- it needs to consider interactions between the package and the product it contains so that the environmental impacts of the product-packaging system as a whole are minimised; and
- it needs to consider 'triple bottom line' impacts of packaging: on the business, on people and on the natural environment.

Sustainable packaging is therefore a complex idea which must be applied with a systems approach and critical thinking. Four principles of sustainable packaging were originally identified by SPA under the headings of 'effective', 'efficient', 'cyclic' and 'clean' and each of these is briefly discussed below. Key performance indicators (KPIs) were also proposed (see **Table 1**). These were expressed in terms such as '*reduces* product waste' and '*improves* functionality' (emphasis added) to highlight the fact that sustainability is a process of continuous improvement rather than a pre-determined endpoint.

Table 1: SPA's first definition of sustainable packaging

Sustainable packaging principle	Sustainable packaging indicator	
1. Effective The packaging system adds real value to society by effectively containing and protecting products as they move through the supply chain and by supporting informed and responsible consumption.	1.1	Reduces product waste
	1.2	Improves functionality
	1.3	Prevents over-packaging
	1.4	Reduces business costs
	1.5	Achieves satisfactory return on investment (ROI)
2. Efficient The packaging system is designed to use materials and energy as efficiently as possible throughout the product life cycle. This should include material and energy efficiency in interactions with associated support systems such as storage, transport and handling.	2.1	Improves product / packaging ratio
	2.2	Improves efficiency of logistics
	2.3	Improves energy efficiency (embodied energy)
	2.4	Improves materials efficiency (total amount of material used)
	2.5	Improves water efficiency (embodied water)
	2.6	Increases recycled content
	2.7	Reduces waste to landfill
3. Cyclic Packaging materials used in the system are cycled continuously through natural or industrial systems, minimizing material degradation.	3.1	Returnable
	3.2	Reusable (alternative purpose)
	3.3	Recyclable (technically recyclable and system exists for collection and reprocessing)
	3.4	Biodegradable
4. Clean Packaging components used in the system, including materials, finishes, inks, pigments and other additives do not pose any risks to humans or ecosystems. When in doubt the precautionary principle applies.	4.1	Reduces airborne emissions
	4.2	Reduces waterborne emissions
	4.3	Reduces greenhouse gas emissions
	4.4	Reduces toxicity
	4.5	Reduces litter impacts

Source: Based on James et al (2005)

3.1.1 Effective

This first principle is primarily concerned with the functionality of packaging. It suggests that packaging will support sustainable development when it 'adds real value to society by effectively containing and protecting products as they move through the supply chain and by supporting informed and responsible consumption'. At a very basic level this is the idea that all products should deliver genuine social value to the user as well as commercial profit to the manufacturer (Papanek, 1971). In the case of packaging, there are many 'users' in the supply chain because manufacturers, wholesalers, retailers and consumers all have an interest in and different expectations of its functionality.

Also included in this principle is the idea of 'sustainable consumption', i.e. that consumers have a responsibility to minimise the impacts of their consumption through careful selection of products and correct disposal. Manufacturers can assist in this process by providing advice to consumers on appropriate disposal including recycling where systems exist.

3.1.2 Efficient

The second principle is that the packaging-product system is designed to use materials and energy as efficiently as possible throughout the product life cycle. This should

include material and energy efficiency in interactions with associated support systems such as storage, transport and handling.' Many writers have argued that in order to reach a state of sustainability we need to significantly reduce our consumption of materials and energy (e.g. von Weizsacker *et al.*, 1997, Schmidt-Bleek, 2000, Weaver *et al.*, 2000). The World Business Council for Sustainable Development promotes eco-efficiency as an opportunity to marry business and environmental objectives by 'creating more value with less impact' (WBCSD, 2000).

While the total amount of material used for the packaging and the product-packaging ratio are important indicators of efficiency, this issue needs to be tackled with caution. Additional packaging can have environmental benefits, particularly for perishable foods, because the environmental benefits of avoided product loss can often far outweigh the environmental costs of additional packaging[2].

3.1.3 Cyclic

The third principle is that 'packaging materials used in the system are cycled continuously through natural or industrial systems, minimising material degradation'. This idea, which has been heavily promoted by William McDonough and Michael Braungart in their book *Cradle to cradle* (2002), is that we should eliminate waste by designing durable products which can be continuously reused, remanufactured or recycled. The important implication for packaging is that it must be designed for recovery through either:

- technical systems, for example the reprocessing of metal packaging back into metal packaging; or
- natural systems, such as the composting of corn-based plastics back into compost or mulch which can be used to grow new crops.

McDonough and Braungart also argue that we need to ensure that a product designed for one system (such as composting) does not contaminate another system (such as recycling).

One major challenge for a significant amount of packaging is that 'closed loop' recycling and re-use is limited in its primary purpose, for example health regulations strictly control the use of recycled materials in packaging designed for food contact. Therefore, secondary applications for packaging waste must be available and appropriately matched in scale to maximise the cyclic potential.

3.1.4 Clean

The fourth principle is that 'packaging components used in the system, including materials, finishes, inks, pigments and other additives do not pose any risks to humans or ecosystems. When in doubt the precautionary principle applies.' The aim is to minimise risks at every stage of the packaging lifecycle by reducing the use of toxic or hazardous materials and by implementing cleaner production programs.

[2] See for example the results of a Dutch study (Bergsma *et al.*, 2004), http://www.cedelft.nl/eng/index.html, accessed 8 November 2007.

4 Measuring progress

These principles were intended to be used to assist decision-making in the design of packaging systems but they can also be used at an industry-wide level to evaluate the sustainability of packaging. In Australia data is only available for a few of the indicators:

- effective – social attitudes to packaging;
- efficiency – total amount of packaging consumed and per capita;
- cyclic – recycling rates; and
- clean – litter impacts.

So how are we going? In relation to the first indicator, the most recent market research data on social attitudes to packaging shows that consumers remain highly ambivalent about it. The environmental impacts of packaging are a low priority when consumers make purchasing decisions in the supermarket (Taverner Research Company, 2004). However, most people express concerns when they are asked specifically about the environmental impacts of packaging:

- a NSW survey found that 66% of people had avoided packaging and 71% had avoided plastic bags in the previous year (DEC, 2006, p. 60);
- the results of a Victorian survey were consistent with NSW: 57% said that they always made a conscious effort to buy goods with little packaging (Ipsos Australia, 2005, p. 31);
- a national Boomerang Alliance survey found that 84% of people thought packaging waste and litter was a problem and 75% said that products have too much packaging (Newspoll, 2004, p. 1); and
- a survey in New Zealand found that all respondents could identify at least one good thing about packaging, but 93% said that packaging was an environmental problem and 61% said that it was a 'huge problem' (Tasman Research and Consultation, 2005, p. 16).

These surveys only examine the attitudes of end consumers, and individuals who work in packaging, product manufacturing or retail are likely to be more positive about packaging. However, the results do indicate that a large proportion of the population regards packaging as environmentally unsustainable.

Another one of the indicators of packaging sustainability in Table 1 was 'material efficiency', or the total amount of material used for packaging. The available data on materials used for packaging shows that consumption has continued to increase despite the efforts of government and industry to promote product stewardship and waste reduction. Between 1996 and 2005, total packaging consumption increased from 2.6 to 4.2 million tonnes per year, an increase of 60%. Packaging consumption per head of population increased 44% over the same period[3].

Between 2003 and 2005 the total recycling rate for packaging increased from 51% to 56% (Martin Stewardship & Management Strategies, 2005, NPCC, 2006), providing an indication that packaging might be becoming more 'cyclic'. However, packaging in the litter stream does not appear to be abating. The latest Keep Australia Beautiful survey (McGregor Tan Research, 2006) found that the total number of packaging items increased by 16% in 2006,

[3] Packaging consumption data for 1996 is from National Environment Protection Council (NEPC, 1998, p. 42); for 2003 from Martin Stewardship and Management Strategies (2005, p. 22) and for 2005 from National Packaging Covenant Council (NPCC, 2006, p. 30). Population data is from the Australian Bureau of Statistics (ABS, 2006a, 2006b).

and most items were packaging-related (**Table 2**). Litter is a social problem because it is a potential hazard to people and wildlife, and based on this indicator alone packaging does not appear to be getting any 'cleaner'.

Table 2: Top dozen litter items in Australia, 2006

Top dozen litter items	Top dozen litter items by volume
Cigarette butts	Illegal dumping
Other paper (including tissues)	Containers, domestic type (plastic)
All other plastic	Containers, industrial e.g. oil (plastic)
Snack bags and confectionary wrappers (plastics)	Cups / takeaway containers (paper)
Metal bottle tops and can pull rings	Newspapers & magazines
Plastic bottle tops	Beer, aluminium, all types
Straws	Flavoured water / soft drink (carbonated) < 1 litre (plastic)
Other glass	Water, carbonated & flavoured / soft drink (metal)
Other foil	Alcoholic sodas & spirit-based mixers (metal)
Cigarette packets	Flavoured water / soft drink (carbonated) 1 litre+ (plastic)
Beer, aluminium, all types	Beer, <750ml, all colours (glass)
Cups / takeaway containers (paper)	Cigarette packets

Source: McGregor Tan Research (2006, p. 25)

5 Recent developments

5.1 National Packaging Covenant Mark II and ECoPP

The National Packaging Covenant (NPC) in Australia is a voluntary agreement between companies in the packaging supply chain and all levels of government to 'achieve a nationally consistent approach to the lifecycle management of consumer packaging and paper, including its recovery, utilisation and ultimate disposal' (NPCC, 2005, p. 1). The revised and updated NPC for the period 2005 - 2010 ('NPC Mark II') has five performance goals and a series of more specific key performance indicators. Those which are directly relevant to the definition of sustainable packaging are listed in **Table 3**. Many of these apply to all of the packaging manufactured by a company or to the processes used to design, manufacture and distribute it, but they could also apply to a single packaging system.

Table 3: Selected NPC goals and KPIs

Goal	Key performance indicator
1. Packaging optimised to integrate considerations about resource efficiency, maximum resource re-utilisation, product protection, safety and hygiene	• Total weight of consumer packaging sold per annum into the Australian market and the total weight of products packaged. • Resources used to produce packaging – energy (MJ) and water (kL). • Improvements in design, manufacture, marketing and distribution to minimise the environmental impacts of packaging. • Changes to protection, safety, hygiene, shelf-life or supply chain considerations affecting amount & type of packaging used. • Average % per annum of post-consumer recycled content in packaging. • Total weight of 'non-recyclable' packaging sold per annum into the Australian market. • Total weight of consumer packaging disposed to landfill. • Consumer packaging as a % by weight of total waste.
2. Efficient resource recovery systems for consumer packaging and paper	• Total weight of consumer packaging recycled. • Total weight of consumer packaging sold to end-users
3. Consumers able to make informed decisions about consumption, use and disposal of packaging of products	• Amount and type of consumer packaging in the litter stream. • Contamination rates in consumer packaging recovery systems. • Improvements in consumer knowledge about the functional attributes of packaging, including recyclability/reuse. • Improvements in littering behavior.
4. Supply chain members and other signatories able to demonstrate how their actions contribute to goals 1-3 above.	• Estimated tonnage of consumer packaging recycled and sent to landfill from on-site collection facilities. • Adoption of the Environmental Code of Practice for Packaging. • Implementation of Buy Recycled purchase policy or practices.

Source: (NPCC, 2005, schedule 2)

The Environmental Code of Practice for Packaging (ECoPP), which forms Schedule 5 of the NPC, provides further indicators of sustainability. For example:

- it recognises the potential for reuse, but argues that it should be designed to minimise life cycle impacts and priority should be given to 'closed loop' reuse rather than reuse for alternative applications;
- it prioritises the use of post-consumer recycled content over other forms of recycled material in order to support kerbside collection programs;

- it suggests that the impacts for packaging should be minimised by eliminating toxic and hazardous substances such as heavy metals and persistent organic pollutants (POPs) where this is justified by a risk assessment; and
- it recommends that companies use environmental labels and declarations which are accurate, verifiable and not misleading, including use of the plastics identification code, recycling logos to encourage recycling, and anti-litter information on all packaging designed to be consumed away from home.

5.2 Packaging Council of Australia initiative

The Packaging Council of Australia (PCA) has recently announced its intention to become more actively engaged in debates about sustainable packaging. In May 2007 the council stated that industry needed to articulate what sustainable packaging means for Australia (PCA, 2007). They define 'a sustainable packaging and product supply chain' as 'a system that enables goods to be produced, distributed, used and recovered with minimum environmental impact at lowest social and economic cost' (p. 1) and argue that the NPC is the principle policy for improving the 'lifecycle management' or sustainability of packaging. They also note that sustainability is a continuing journey rather than an end in itself because it is unlikely that any consensus could be reached amongst stakeholders on when an industry such as packaging has become sustainable.

A major concern of the PCA appears to be the need to ensure that key stakeholders understand the environmental and social benefits of packaging. For example, they state that (PCA, 2007, p. 2):

> 'The industry needs to take the lead in demonstrating that packaging adds environmental value to the Australian community.'
>
> '[C]onsumers generally hear the contrary view of 'bad' packaging without an appropriate balancing context.'
>
> 'Prompt dissemination of accurate, verifiable information helps to counter inaccurate or misleading information by packaging opponents...'

While the statement is only brief and of a general nature, it does highlight issues which the council believes are important to the sustainability of packaging:

- the positive role played by packaging in providing convenient, safe and cost-efficient delivery of packaging;
- the environmental benefits of packaging include protecting products from damage, more efficient transport and increased shelf-life of perishable products; and
- recycling is a visible means of demonstrating sustainability because it delivers savings in waste to landfill, greenhouse gas emissions and water consumption.

Importantly the PCA recognises that one of the drivers of industry sustainability is 'risk reduction given the threats of a carbon-constrained economy'. They also state that recycling programs need to be 'optimised' to yield further greenhouse savings. The PCA's statement therefore highlights links between packaging sustainability and current debates about global warming which are discussed further below.

5.3 Sustainable Packaging Coalition

Unlike SPA, the Sustainable Packaging Coalition (SPC) in the United States is a membership-based organisation. Its members include many large multi-national companies

such as McDonald's, Coca Cola, Huhtamaki, Unilever, Kraft Foods and Johnson and Johnson as well as many small to medium sized companies[4].

In 2005 SPC produced its own definition of sustainable packaging (SPC, 2005) to ensure that 'all parties are working towards the same vision'. In their view, 'sustainable packaging (SPC, 2005, p. 1):

- is beneficial, safe & healthy for individuals and communities throughout its life cycle;
- meets market criteria for performance and cost;
- is sourced, manufactured, transported, and recycled using renewable energy;
- maximizes the use of renewable or recycled source materials;
- is manufactured using clean production technologies and best practices;
- is made from materials healthy in all probable end of life scenarios;
- is physically designed to optimize materials and energy;
- is effectively recovered and utilized in biological and/or industrial cradle to cradle cycles.'

This SPC definition has many synergies with the SPA definition but it goes further, particularly in relation to renewable energy and materials. For example, te SPC urges a rapid transition from fossil-fuel based to renewable energy sources such as solar, wind, hydroelectric, tidal, geothermal and biomass energy (including bio-fuels). They also recognise the importance of strategies such as the purchase of carbon credits during the 'transition period'. Carbon credits are becoming popular with the increasing intensity of the global warming debate (discussed further below) but there has been criticism in Australia that many schemes provide more 'greenwash' than genuine environmental improvement. The SPC also encourages the use of bio-fuels for transportation, but questions have been raised about the ecological impacts of growing crops, particularly when rainforests are cut down to plant crops such as palm oil (MacKinnon, 2007). The promotion of renewable materials also needs to consider the environmental impacts of forestry and agricultural activities to produce paper or starch-based polymers. A recent life cycle assessment of several products made from both renewable and non-renewable resources (Uihlein *et al.*, 2007) concluded that there is no clear cut advantage for renewable materials on environmental grounds. For example, while the results showed that cups made from a biopolymer (polylactic acid) had a slightly lower overall impact than cups made from polystyrene, ethanol from corn had a slightly higher impact than gasoline. A broader social issue is the competition for land for biofuels and food supplies; something which is likely to reduce the supply and increase prices for food in the future.

This is an important issue which should be addressed in SPA's updated definition.

[4] http://www.sustainablepackaging.org/, accessed 8 November 2007.

5.4 Packaging evaluation tools

A number of environmental evaluation tools have recently been developed to support the design or procurement of more sustainable packaging. Unlike the NPC indicators, these apply to a single product rather than a company or sector.

SPA has developed the ***Packaging Impact Quick Evaluation Tool (PIQET©)*** which has a series of indicators including both packaging-specific and standard Life Cycle Assessment (LCA) indicators.

Packaging specific indicators include:

- product/packaging ratio;
- percentage of product remaining in packaging;
- packaging to landfill as a percentage of the total and by weight;
- packaging to recycling as a percentage and by weight (kg);
- percentage of recycled content of packaging per pallet load;
- packaging as a percentage of packaged product weight (kg);
- weight and percentage of packaging per packaging level (sub-retail, retail, merchandising, traded and pallet);
- weight of packaging which is recyclable (kg);
- recycled content of each individual packaging component; and
- packaging material summary (number of each individual packaging material in packaging system format).

LCA indicators include:

- global warming (kg CO_2 eq);
- cumulative energy demand (MJ LHV);
- minerals and fuel (MJ surplus);
- photochemical oxidation (kg C_2H_2 eq);
- eutrophication (kg PO_4^{3-} eq);
- land use (HA);
- water use (kL H_20); and
- solid waste (kg).

PIQET can be used to demonstrate to company stakeholders such as customers, suppliers, shareholders and government, a continous improvement approach to packaging sustainability. It can also inform NPC Action Plans and assist in the reporting of specific NPC KPIs including (Verghese *et al.*, 2006):

- setting individual NPC targets (KPI 29);
- demonstrating the systematic application of ECoPP (KPI 22) which will be embedded within the tool; and
- providing a scientific basis for supporting and quantifying changes in packaging (KPI 4) and/or demonstrating and quantifying improvements in packaging (KPI 3).

Wal-Mart is promoting itself as a leader in sustainable packaging through initiatives such as their environmental scorecard. They are promoting a number of principles including eliminating unnecessary packaging; eliminating materials harmful to human health and the environment; 'right-sizing' packaging, for example by optimising material strength; use of recyclable or reusable transport packaging; use of renewable, recyclable and recycled content materials; and achieving all principles at cost parity or cost savings (Wal-Mart, 2007). The ***Wal-Mart environmental scorecard*** was developed to encourage suppliers to work towards continuous improvement and assist buyers to select packaging with reduced environmental impact (Wal-Mart, 2006). All suppliers of packaged goods are required to submit data on nine criteria:

- greenhouse emissions from production;
- material type and value;
- emissions from transport;
- product / packaging ratio;
- cube utilisation;
- recycled content;
- methods of waste recovery;
- use of renewable energy; and
- innovation.

Through the on-line scorecard each supplier is given an overall sustainability score relative to other suppliers, a relative score on each of the nine criteria, and suggestions for improvement (Wal-Mart, 2007). However, it has been strongly criticised by industry lobby group EUROPEN who argue that it is based on flawed logic and data and 'should not be allowed to become a *de facto* packaging environmental standard' (Carroll, 2007, p. 5). While acknowledging that the scorecard is a 'work in progress', the Managing Director of EUROPEN highlighted some specific concerns, for example:

- the greenhouse gas measurement excludes all life cycle steps except material manufacturing;
- the product-to-packaging ratio discourages smaller portions which are an obesity-reduction measure;
- the recovery value of packaging excludes primary packaging taken home by the consumer and only focuses on packaging which remains in the custody of Wal-Mart; and
- the use of renewable energy as a criterion does not give any credit for energy efficiency.

The ***Sustainable Packaging Coalition (SPC)*** has obtained an exclusive license from environmental lobby group Environmental Defense for the packaging design aspect of the ***MERGE™ tool.*** It calculates an environmental profile for a package design for seven criteria and can be used by designers to quickly screen packaging designs early in the development process. The SPC is currently updating the Life Cycle Inventory (LCI) data sets in MERGE™ and is working on a redevelopment of the next generation of the tool[5].

The on-line ***Tool for environmental Optimisation of Packaging design (TOP)*** was developed in the Netherlands (Kiem Sustainable Innovations and CREM, 2003). The development of this simple software tool was commissioned by the Netherlands Packaging Centre (NVC) and was funded by the government with input from thirty major packaging

[5] http://www.sustainablepackaging.org/projects.asp, accessed 6 November 2007.

supply chain companies. The TOP tool links industrial packaging development processes with the *Essential Requirements*[6] of the *European Packaging Directive* and evaluates packaging in conjunction with the product. The tool contains an explanatory description with examples and practice calculations and work sheets (in Excel) via a CD or on-line. There are seven indicators:

- product-packaging combination:
- added value;
- logistics efficiency;
- heavy metals;
- re-use and recovery;
- material consumption; and
- environmental impact (Eco-Indicator single point).

One of the limitations is that the focus is on compliance with the EU *Essential Requirements* and so is less relevant to packaging companies outside the EU.

A previous attempt to develop a methodology for the environmental evaluation of product-packaging systems in the Netherlands was apparently abandoned because agreement could not be reached among stakeholders about the results of a feasibility study (Carroll, 2007)[7]. The European Parliament also proposed in 2003 to develop a Packaging Environmental Indicator based on a single point indicator and a feasibility study was published in late 2006 with less than positive results (Carroll, 2007).

5.5 Global warming and carbon accounting

Over the past couple of years international concerns about global warming have increased. This can be attributed to several events, including publication of the 'Stern Review' on the economics of climate change (Stern, 2006), the most recent reports by the International Panel on Climate Change (e.g. IPCC, 2007) and the release of Al Gore's film *An Inconvenient Truth*. In Australia the continuing drought is contributing to public concerns that the climate appears to be getting hotter and drier. These concerns have resulted in a proliferation of schemes promoting 'carbon offsets', supported by mandatory renewable energy targets and policies to establish emission trading schemes. Many companies in Australia and around the world have announced their intention to become 'carbon neutral'. In January 2007 Tesco announced its intention to put 'carbon labels' on all of their products to provide information on their carbon footprint from production through to consumption (Leahy, 2007).

One of the problems with simplistic definitions such as those developed by SPA and SPC is that they tend to obscure the complexities involved in minimising the environmental impacts of a product, for example the trade-offs which might exist between recycling and energy consumption. Recycling should not be viewed as an environmental objective in its own right; but merely a strategy to achieve environmental objectives such as reductions in pollution and greenhouse gas emisisons throughout the product-packaging lifecycle. This criticism has been made of waste policy by consultants Grant Thornton (2006) who have argued that high recycling rates for glass in the UK are being achieved by diverting crushed glass into applications such as filtration sand, which generates more carbon dioxide than if the glass

[6] In summary, the *Essential Requirements* are that packaging weight and volume should be minimised to the amount needed for safety and acceptance of the packed product; noxious and other hazardous constituents of packaging should have minimum impact on the environment at end of life; and packaging should be suitable for material recycling, energy recovery or composting or for reuse if reuse is intended. More detail is provided in a series of standards developed by the European Committee for Standardization (CEN).

[7] The full study is available at http://www.cedelft.nl/eng/index.html, accessed 8 November 2007.

was sent to landfill. A life cycle assessment of post-consumer recycling in Australia (Grant *et al.*, 2003) concluded that most of the environmental benefits of recycling are due to the avoided impacts of virgin material production rather than the avoided impacts of landfill. As a result, strategies to encourage increased recycling of packaging need to take into account the environmental impact of doing so, such as greenhouse gas emissions. In other words, recycling rates should be *optimised* rather than *maximised*.

Another issue which is relevant to sustainable packaging is the impact that renewable and degradable materials, such as paper and biopolymers, have on greenhouse gas emissions. As they break down in landfill or composting facilities, degradable materials generate methane emissions, and methane is twenty-one times more damaging as a greenhouse gas than carbon dioxide. While many landfills recover methane and generate energy from it after capping, gas capture is incomplete.

Finally, the transport of food products is becoming more prominent as an environmental issue through the debate on 'food miles', which calls on consumers to buy food locally (see for example Ellis, 2007). Food miles are the distance travelled by food from the 'paddock to the plate'. In response to customer concerns about food transport, both Tesco and Marks & Spencer in the UK have announced that they plan to put an airplane symbol on products which have been imported by air freight. The environmental impact of freight increases with distance travelled, and air freight has higher environmental impacts than sea or road transport. However, a recent report for the UK government (AEA Technology, 2005) concluded that food miles are inadequate as a single measure of sustainability. While the environmental and social impacts of food transport are significant, they need to be weighed up against other impacts such as the energy costs of growing food in colder climates such as the UK compared to warmer countries such as Spain.

These issues – the energy and greenhouse impacts of renewable materials, degradable materials and transport, need to be considered in the revised SPA definition of sustainable packaging.

5.6 Other global initiatives

There is no doubt that the search for 'sustainable packaging' is being taken up by many other companies, industry associations and research groups throughout the world. Some examples which illustrate this trend include:

- conferences and courses: in the United States a *Designing for Sustainable Packaging* 'webinar' will be held in December 2007[8] and a *Sustainable Packaging Design* workshop and expo in January 2008[9];
- conferences in Europe such as the *Amsterdam Packaging Summit* (June 2007) with a focus on sustainability and the *Sustainable Footprint Conference* in London (PiraIntertech, November 2007);
- industry associations: the Institute of Packaging Professions in the US has established a Sustainable Packaging Technical Committee and a Definitions Sub-group[10];
- consultants: James Ross Consulting offers a range of sustainability services for packaging including best-in-class analysis, carbon footprints for different options,

[8] www.packagedesignmag.com/sustainablewebinar, accessed 5 November 2007.
[9] http://bnevents.com/PS/2007/SPF/index.htm, accessed 5 November 2007.
[10] www.iopp.org/pages/index.cfm?pageid=1416, accessed 5 November 2007.

completion of the Wal-Mart environmental scorecard and development of design principles[11];

- non-government organisations: London Remade, a not-for-profit organisation which is funded by the London Development Agency, recommends suppliers of sustainable packaging[12]; and
- companies: Green Mountain Coffee Roasters in the United States is pursuing sustainable packaging as part of its corporate focus on social and environmental responsibility[13].

There is some scepticism about whether or not sustainable packaging can be achieved. A packaging consulting group provides an introduction to sustainability and the SPC definition on their web site, but states that (Packaging 2.0, 2006):

> 'Currently, meeting this strict definition would be virtually impossible for the majority of transportation, protective and display packaging systems where commingled materials and global manufacturing complicate the cycling of materials through collection and reuse.
>
> For now most companies are setting attainable environmental packaging goals that are less bad in practice when compared to their existing methods.'

In a similar vein, a journalist writing for Food in Canada (Reeves, 2007, p. 26) has noted that '[f]inding examples of sustainable packaging is difficult because sustainability is not an absolute, but a question of degree; some packages are more sustainable than others'. Reeves also notes that 'there is no silver bullet' but there are many small steps that companies can take to improve sustainability, such as improving cube utilisation.

6 Sustainable packaging redefined

Some of these other initiatives have been compared to SPA's definition of sustainable packaging in **Appendix A**. By comparing SPA's principles (effective, efficient, cyclic and clean), with the principles, strategies and KPIs which have been proposed by others, it is possible to see many synergies as well as gaps. Gaps which were highlighted by the review and have been addressed include renewable energy and renewable materials.

A revised definition has been developed in order to fill these gaps (**Table 4**). The four principles have been clarified, strategies have been added, and wherever possible, strategies and KPIs are consistent with those in the NPC and ECoPP. The principles should remain fairly consistent over time (figure, while the strategies and KPIs are amended to meet changing or individual circumstances.

[11] http://www.jamesrossconsulting.com/global/international/services/sustainability.aspx, accessed 5 November 2007.
[12] http://www.londonremade.com/download_files/Sustainable%20packaging%20suppliers.pdf, accessed 5 November 2007.
[13] http://www.packworld.com/newsletters/sp-09-17-07.html, accessed 5 November 2007.

Figure 1: The four principles of sustainable packaging

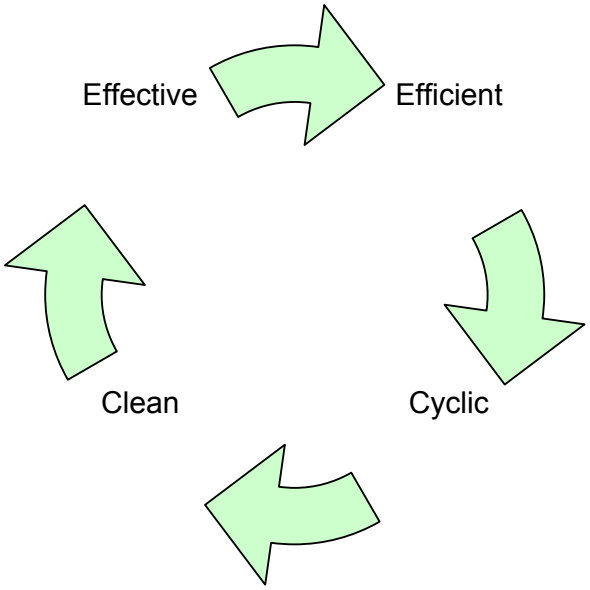

Table 4 Revised SPA sustainable packaging definition, strategies and key performance indicators

Principles	**Strategies for packaging design, manufacture, logistics and marketing**	**KPIs**
Effective: social and economic benefit The packaging system adds real value to society by effectively containing and protecting products as they move through the supply chain and by supporting informed and responsible consumption.	Eliminate any packaging which is not necessary (can the product-packaging system be redesigned to eliminate one or more component?). Ensure that the packaging fulfils supply chain requirements for product protection, containment, distribution, retailing and use. Design the product-packaging system to minimise total life cycle environmental impact.	Functionality of each component of the packaging system (list). Social and economic benefits of the packaging system as a whole (list). Product-packaging ratio by weight (tonnes of product divided by tonnes of packaging).
	Minimise overall supply chain costs.	Supply chain costs ($ per unit of product)
	Provide information to consumers on environmental attributes of the packaging.	Specific, relevant, accurate and verifiable environmental claims consistent with ISO 14021.
	Provide advice to the consumer on correct disposal of the packaging.	Recycling logos and advice on recyclable packaging. Plastics identification code correctly used on plastics packaging (PACIA guidelines). Instructions NOT to recycle on containers used for hazardous products.
Efficient: doing more with less The packaging system is designed to use materials and energy efficiently throughout the product life cycle. Efficiency can be defined through reference to world's best practice at each stage of the packaging life cycle.	Reduce packaging volume and weight to the minimum required for product protection, safety, hygiene and acceptability to the consumer. Increase the efficiency of the product-packaging system by changing the product, e.g. use of concentrates.	Total weight of material used in the packaging system (breakdown between sub-retail, retail, merchandising and traded unit levels). Product-packaging ratio by weight (tonnes of product divided by tonnes of packaging).

	Minimise product waste	Percentage of product which becomes waste before it reaches the consumer (e.g. is damaged in transit). Percentage of product remaining in retail unit packaging (once consumer has dispensed product).
	Maximise energy and water efficiency during manufacturing and recovery systems.	Energy consumed over the packaging lifecycle (MJ per tonne of packaging). Water consumed over the packaging lifecycle (kL per tonne of packaging).
	Improve transport efficiency, e.g. through maximum cube utilisation.	Pallet configuration and efficiency - cube utilisation (%).
<u>Cyclic: optimising recovery</u> Packaging materials used in the system are cycled continuously through natural or industrial systems, with minimal material degradation. Recovery rates should be optimised to ensure that they achieve energy and greenhouse gas savings.	Identify the cyclic loops which are available to recover the packaging and ensure that the packaging can be collected and processed within them.	Collection and reprocessing systems for the packaging (list).
	Reusable packaging: design to minimise lifecycle impacts, e.g. by maximising return rates. Design for 'closed loop' reuse in preference to an alternative use.	Reusability (national recovery rate for the product through company / industry schemes).
	Recyclable packaging: specify a material with an existing and widespread system for recovery. If possible use only one material, if not use materials which are easy for the consumer to separate or do not contaminate recycling systems. Design for 'closed loop' recycling rather than 'downcycling'. Use the maximum amount of recycled content which is physically possible (preferably post-consumer).	Recyclability (national recovery rate for the material through recycling systems). Percentage of the packaging (by weight) which can be recovered through available recycling processes. Average % of recycled material (post consumer). Average % of recycled material (total).
	Degradable packaging: specify compostable rather than oxo-degradable materials and ensure that a system is available for collection and processing.	Compostability (national recovery rate for the product through composting systems).
	Specify renewable materials where it is demonstrated they provide the lowest environmental impact.	Percentage of packaging material which is from a renewable source.
	Use renewable stationary energy (e.g. by purchasing 'Greenpower').	Percentage of stationary energy use which is from a renewable source.
	Use renewable transport energy (e.g. biofuels) where these are found to have the lowest environmental impact.	Percentage of transport energy which is from a renewable source.
<u>Safe: non-polluting and non-toxic</u> Packaging components used in the system, including materials, finishes, inks, pigments and other additives do not pose any risks to humans or ecosystems.	Manufacture packaging using cleaner production techniques and using best practice materials and energy consumption technologies.	Cleaner product policies and procedures (list).
	Avoid or minimise the use of heavy metal-based additives (<100 ppm per packaging unit).	Use of heavy metal-based additives (list) and concentration (ppm).

When in doubt the precautionary principle applies.	Avoid or minimise the use of materials or additives that may migrate into food and be harmful to human health, e.g. certain plasticisers. Avoid or minimise the use of materials or additives which may pose risks to humans or ecosystems during recovery or disposal.	Health or environmental risks associated with the package (list).
	Minimise the environmental impacts of transport (considering distance, mode of transport and fuel type).	Transport distances at each stage of the packaging life cycle (km). Mode of transport used for each stage of the packaging life cycle (km). Fuel type used for each stage of the packaging life cycle (list).

7 Implications for corporate practice

This definition can be used by companies to guide their packaging and product stewardship strategies. It must be adapted to the specific needs and priorities of each company (**Table 5**), based on factors such as:

- feedback from customers about their environmental concerns and expectations;
- the functional requirements of the product-packaging system, for example shelf-life or product protection, which might restrict packaging options; and
- regulatory requirements in export markets, for example companies exporting to countries in the European Union must meet the *Essential Requirements* and recycling regulations in individual countries, while companies in Australia and New Zealand must particulate in the NPC and the Packaging Accord respectively.

While the principles of sustainable packaging (effective, efficient, cyclic and clean) should be relevant to every business, packaging strategies must be selected based on the environmental impacts and specific circumstances relating to each product-packaging system.

The definition can be used to guide corporate strategy and new product development (NPD) processes by integrating it within existing business policies and systems. For example, a company's environment policy should include a commitment to reduce the environmental impacts of its products and packaging throughout their life cycle and reference to the sustainable packaging principles. If a company has an environment management system then this should also include the environmental aspects and impacts associated with packaging.

A company's packaging strategy should include objectives, targets and KPIs relating to sustainability. In order to do this, decisions need to be made about the priority which will be given to efficiency objectives such as lightweighting and cyclic objectives such as recyclability. These decisions will depend on the results of any environmental impact evaluation, market research and consultation with supply chain partners.

The definition can then be used to guide NPD processes, for example by integrating the principles and appropriate strategies into packaging design briefs. Some companies have also developed their own packaging design guidelines and checklists and these are used at concept and detailed design stages. 'Gatekeepers' at key points in the design process should ensure that sustainable packaging principles and strategies have been addressed before giving approval for the project to proceed further. Guidelines should also be developed for consumer labelling to ensure that environmental claims and consumer information are appropriate.

The collection of KPI data is essential for internal management, for example measuring progress against objectives and targets, as well as external reporting purposes. For example, many companies publish annual environment or sustainability reports and companies in Australia are required to report annually to the NPC Council on progress against their action plan.

Table 5: Integration of the sustainable packaging definition in business systems

Business activity	Opportunities to integrate packaging sustainability
EMS	The environment policy includes reference to principles of sustainable packaging. Environmental aspects and impacts of packaging identified in the EMS.
Sustainability strategy	Includes sustainable packaging principles, strategies and targets.
Packaging strategy	Sustainability objectives are identified as well as those relating to functionality, cost, labelling etc.
Procurement policy	Suppliers are required to meet sustainable packaging guidelines and to provide KPI data where necessary.
New product development	Sustainable packaging principles and strategies are included in guidelines and checklists for NPD. A streamlined environmental evaluation is undertaken for all new packaging. Packaging is evaluated against world's best practice.
Public reporting	The company's sustainable packaging principles and objectives publicly available on the corporate web site or in public reports. Data collected annually on sustainable packaging KPIs and reported in environment or sustainability reports (plus country-specific reports, e.g. the NPC in Australia).

8 Research priorities

This review of sustainable packaging initiatives and revision of the definition have highlighted continuing gaps in our knowledge about packaging sustainability. The following are some examples:

- ***Best practice***: WRAP has developed a tool for the evaluation of packaging *efficiency* against 'best-in-class' in the UK, measured by weight of packaging[14]. However, what is best practice in *sustainable packaging* for particular product-packaging systems? What variables will influence sustainability, for example under what circumstances would is it more appropriate to manufacture a package from biodegradable PLA rather than PET, and vice versa? What represents 'best practice' distribution packaging for particular sectors?
- ***Renewable and biodegradable materials***: Are these really more sustainable than materials based on non-renewable resources? What are the benefits of degradability and how can the environmental costs (such as greenhouse gas emissions) be minimised? What are the social trade-offs in terms of cost of food and access to agricultural land?
- ***Social sustainability***: The social aspects of sustainability are considered important in many supply chains, for example sweat shops and the use of child labour in Asian supply chains have been a particularly sensitive issue for brandowners in the textile, fashion and footwear industries. Other social issues include equal employment opportunities, OH&S, human rights and the impacts of globalisation. What are the most important social issues for sustainable packaging?
- ***Environmental labelling***: While companies are encouraged to follow the ISO 14021 standard (*Environmental labels and declarations - Self-declared environmental claims*), consumer labelling on packaging tends to be very ad hoc. Environmental

[14] www.wrap.org.uk/retail/tools_for_change/uk_best_in_class, accessed 5 November 2007.

claims and labels are often non-existent or confusing, or provide inadequate information to allow consumers to make an informed choice based on environmental impacts of packaging. What are the best options for improved labelling practices, particularly in the context of current interest in carbon labels? Do carbon labels provide a simply and relevant measure of environmental impact, or do they have potential to mislead consumers? Is there a better alternative?

9 Conclusion

This paper has provided an update on earlier work by SPA on defining sustainable packaging. Since this original work was undertaken in Australia, the SPC has published its own definition and encouraged more rigorous discussion on this issue, particularly amongst US-based corporations. The largest retailer in the world, Wal-Mart, is now putting pressure on its suppliers to provide more environmentally sustainable packaging, and this is likely to be a much stronger driver of change than slow-moving government regulations. PCA and other packaging industry associations have also become more engaged in sustainability.

Based on a review of these and other recent developments, SPA has revised and expanded its definition of sustainable packaging to include relevant strategies and more detailed KPIs. These bring it into line with developments such as the revised NPC and ECoPP in Australia, while addressing complex issues which were previously not included such as the choice between renewable and recyclable materials. These changes provide a more useful framework to support the development of sustainable packaging strategies within firms. They also highlight research gaps in areas such as best practice packaging, biodegradable materials, social sustainability and environmental labelling.

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Appendix A: Links between SPA definition and other initiatives

SPA principles (version 1)	SPC	NPC	ECoPP	PCA	PIQET	Wal-Mart
Effective The packaging system adds real value to society by effectively containing and protecting products as they move through the supply chain and by supporting informed and responsible consumption. *KPIs:* Reduces product waste; Improves functionality; Reduces business costs; Achieves satisfactory ROI.	*Principles:* Beneficial... for individuals and communities throughout its lifecycle; Meets market criteria for performance and cost.	*Principles:* Packaging optimised to integrate considerations about ... product protection, safety and hygiene. *KPIs:* Changes of protection, safety, hygiene, shelf-life or other considerations affecting amount & type of packaging. Improvements in consumer knowledge about the functional attributes of packaging, including recyclability/reuse.	*Principles:* Packaging volume and weight limited to the minimum required for product safety, hygiene and acceptability to the consumer; Labelling on packaging should aim to encourage consumption of products with reduced impact by providing information on environmental aspects; Labelling should be used to encourage recycling; Plastics identification codes and anti-litter information should be included where relevant.	*Principles:* The role of packaging in providing convenient, safe and cost-efficient delivery of products; The environmental benefits of packaging including product protection.	*KPIs:* Percentage product remaining in packaging.	*KPIs:* Material type and value.
Efficient The packaging system is designed to use materials and energy as efficiently as possible throughout the product life cycle. This should include material and energy efficiency in interactions with associated support systems	*Principles:* Is physically designed to optimise materials and energy.	*Principles:* Packaging optimised to integrate considerations about resource efficiency... *KPIs:* Total weight of packaging sold...and	*Strategies:* Packaging volume and weight limited to the minimum required for product safety, hygiene and acceptability to the consumer.		*KPIs:* Product/packaging ratio; Packaging to landfill/recycling as a % and by weight (kg); Packaging as a % of	*KPIs:* Product / packaging ratio; Cube utilisation.

such as storage, transport and handling. KPIs: Improves product / packaging ratio; Improves efficiency of logistics; Improves energy efficiency (embodied energy); Improves materials efficiency (total material used); Increases recycled content; Reduces waste to landfill.		total weight of products packaged; Resources used to produce packaging (water, energy).	Environmental impacts of energy consumption minimised across the supply chain; Design of the product-packaging system optimises transport efficiency (and therefore fuel consumption).		packaged product weight; Weight (kg) and % of packaging per packaging level (sub-retail, retail, merchandising, traded and pallet); Weight (kg) of recyclable packaging; Recycled content of each individual packaging component; packaging material summary (number of each individual packaging material in packaging system format); Minerals and fuel demand; Water use; Cumulative energy demand; Land use.	
<u>Cyclic</u> Packaging materials used in the system are cycled continuously through natural or industrial systems, minimizing material degradation. *KPIs:* Returnable (closed loop); Reusable (alternative use);	*Principles:* Is sourced, manufactured, transported and recycled using renewable energy (transitional strategies include the purchased of carbon credits); Maximises the use of	*Principles:* Packaging optimised to integrate considerations about ... maximum resource re-utilisation...; Efficient resource recovery systems...; Consumers able to	*Principles:* Reuse – demonstrated practicality and environmental benefit; priority to reuse for the same application (closed loop) followed by reuse for an alternative	*Principles:* The benefits of recycling in delivering less waste, greenhouse gas emissions and water consumption. *Strategies:* Optimise recycling to	*KPIs:* Recycled content (%) of packaging per pallet load; Solid waste.	*KPIs:* Recycled content; Use of renewable energy; Methods of waste recovery.

Recyclable (technically recyclable and recovery system in place); Biodegradable (technically biodegradable and recovery system in place).	renewable or recycled source materials; Is effectively recovered and utilised in biological and/or industrial cradle to cradle cycles.	make informed decisions about consumption, use and disposal of packaging... *KPIs:* Average % of post-consumer recycled content; Total weight of 'non-recyclable' packaging sold...; Contamination rates in consumer packaging recovery systems; ...tonnage of consumer packaging recycled and sent to landfill from on-site collection facilities; Implementation of Buy Recycled...policies or practices.	application; designed to minimise lifecycle environmental impacts e.g. by maximising return rates. Recycling – Design to maximise potential for recovery and minimise environmental impacts of disposal; preference for closed loop recycling rather than 'downcycling'. Recycled content – maximise where physically possible; priority given to Australian post-consumer recycled content.	yield further greenhouse gas savings.		
<u>Clean</u> Packaging components used in the system, including materials, finishes, inks, pigments and other additives do not pose any risks to humans or ecosystems. When in doubt the precautionary principle applies. *KPIs:* Reduces generation of airborne	*Principles:* Is...safe & healthy for individuals and communities throughout its lifecycle; Is manufactured using clean production technologies and best practices; Is made from	*Principles:* Amount and type of consumer packaging in the litter stream; Improvements in littering behavior.	*Principles:* Evaluate and minimise risks associated with the use of toxic substances; If a company's packaging is found in the litter stream then they should reduce the impacts of litter	*Principles:* The benefits of recycling in delivering less waste, greenhouse gas emissions and water consumption.	*KPIs:* Number of detachable components; Greenhouse gas emissions; Photochemical oxidation.	*KPIs:* Greenhouse gas emissions; Emissions from transport.

emissions; Reduces generation of waterborne emissions; Reduces toxicity; Reduces litter impacts.	materials healthy in all probable end-of-life scenarios.		by minimising the number of components and providing information to consumers on disposal.			

Hence, the sustainable packaging design often has a less-than-desirable net impact on the environment. And this doesnâ€™t even include the effects of having less feedstock for incinerators to recover energy from. Designing for recycling is certainly imperative to future-proof oneâ€™s business, our economy and humanity itself.Â For the latter, political lobbying may be needed to redefine governmental regulations on what counts as recycling. 8. New Out-of-the-Box Ideas.