I. A Vision for Sustainable Packaging

The Sustainable Packaging Coalition envisions a world where all packaging is sourced responsibly, designed to be effective and safe throughout its life cycle, meets market criteria for performance and cost, is made entirely using renewable energy and once used, is recycled efficiently to provide a valuable resource for subsequent generations. In summary: a true a cradle to cradle[1] system for all packaging.

The mission of the Sustainable Packaging Coalition is to advocate and communicate a positive, robust environmental vision for packaging and to support innovative, functional packaging materials and systems that promote economic and environmental health.

The purpose of this document is to take the important first step in articulating an agreed upon definition of the term “sustainable packaging” so that all parties are working toward the same vision. By providing a common framework, the packaging industry can evaluate current efforts, identify opportunities and begin to pursue strategies to develop sustainable packaging materials and systems.

The definition is intended as a “target vision” for companies to strive toward through continuous improvement and will evolve over time with new materials and technologies.

II. Definition of Sustainable Packaging

The criteria presented here blend broad sustainability objectives with business considerations and strategies that address the environmental concerns related to the life cycle of packaging. These criteria relate to the activities of our membership and define the areas in which we actively seek to encourage transformation, innovation and optimization. We believe that by successfully addressing these criteria, packaging can be transformed into a cradle to cradle flow of packaging materials in a system that is economically robust and provides benefit throughout its life cycle – a sustainable packaging system.

Sustainable packaging [2]:

A. Is beneficial, safe & healthy for individuals and communities throughout its life cycle;
B. Meets market criteria for performance and cost;
C. Is sourced, manufactured, transported, and recycled using renewable energy;
D. Maximizes the use of renewable or recycled source materials;
E. Is manufactured using clean production technologies and best practices;
F. Is made from materials healthy in all probable end-of-life scenarios;
G. Is physically designed to optimize materials and energy;
H. Is effectively recovered and utilized in biological and/or industrial cradle to cradle cycles.

These criteria outline a framework for specific actions. The SPC recognizes that the timelines for achievement will vary across criteria and packaging materials. Together, these criteria characterize our vision of sustainable packaging.

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[1] Cradle to Cradle Design is based on principles of Industrial Ecology and Design for Environment (DfE). Similar to Industrial Ecology, materials and energy flows are conceived as ‘metabolism’ and like DfE, it proposes that we design with the environment in mind, considering all phases of the product life cycle.
[2] No ranking is implied in the order of criteria

III. Explanation of Criteria

A. Beneficial, Safe & Healthy for Individuals and Communities Throughout its Life Cycle

i. Relevance to Sustainable Development

In addition to "profitability" the other two pillars of sustainability --social equity and the environment-- are growing areas of corporate focus. As part of globalization, companies are expanding operations and are increasingly being held accountable for actions resulting in negative social or environmental consequences. The emergence of the corporate social responsibility report reflects the growing focus on corporate citizenship, accountability, and transparency.

ii. Relevance to Packaging

The global packaging industry is conservatively estimated at $417 billion and employs more than five million people all over the world[3]. The benefits of packaging to individuals and communities vary from the creation of meaningful, stable employment, to the protection, preservation, safety, and transport of products and food stuffs. Packaging allows key marketing and product differentiation and educates and informs the consumer. At the same time, the procurement, production, transport and disposal of packaging can have negative consequences for both the environment and societies around the globe. The SPC believes that through intelligent packaging and system design, it is possible to "design out" the potential negative impact of packaging on the environment and societies.

iii. Strategies & Opportunities

Cradle to cradle principles offer strategies to improve the material health of packaging and close the loop on packaging materials including the creation of economically viable recovery systems that effectively eliminate waste. These strategies support communities through the creation of gainful employment and improvements to the environment. Corporate social responsibility, accountability and equitable wages are all part of creating a sustainable system.

B. Meets Market Criteria for Performance and Cost

i. Relevance to Sustainable Development

Economic growth and prosperity are essential components of sustainable development. The United Nations estimates that the population of the planet will grow from 6.4 billion in 2005 to 9.0 billion by 2050, roughly a 40% increase in global population[4]. Efficient and productive industry engaged in truly sustainable practices is essential to meet the incredible increase in demand for goods and resources that this growth implies. Historically, increased packaging use has accompanied economic growth. A goal of sustainable packaging is to facilitate economic growth by delivering benefits of packaging without the negative impacts associated with traditional packaging designs.

ii. Relevance to Packaging

Ongoing profitability is a fundamental element of sustainable business practice. Managing the cost of packaging procurement, production, and product delivery with the desired functionality and appearance are key to a profitable business. The SPC membership has observed that the true cost of packaging is becoming more complicated as costs that have traditionally been borne by society (e.g., disposal) are being redirected to producers through legislation and levies. Sustainable packaging design considers the full life cycle of the package, recognizes the principle of Shared Product Responsibility[5] and consequently seeks to minimize the total packaging system cost through efficient and safe package life cycle design.

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[3] PRIMEDIA Business Magazine & Media, Inc. Global Packaging Market, February 1, 2003. Online. Paper, Film & Foil Converters. July 22, 2005 <*http://pffconline.com/mag/paper_global_packaging_market/*>

[4] Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. World Population Prospects: The 2004 Revision and World Urbanization Prospects: The 2003 Revision, 2005. Online. United Nations. July 22, 2005 <*http://esa.un.org/unpp*>

[5] OECD defines Shared Product Responsibility as a voluntary system that ensures responsibility for the environmental effects throughout a product's life cycle by all those involved in the life cycle. The greatest opportunity for extended product responsibility rests with those throughout the commerce chain – designers, suppliers, manufacturers, distributors, users and disposers – that are in a position to practice resource conservation and pollution prevention at lower cost. *http://www.biac.org/statements/env/FIN97-12_biac_discussion_paper_epr.pdf*

iii. *Strategies & Opportunities*

Sustainable packaging initiatives offer multiple strategies to meet and even exceed market criteria for performance and cost, including: improved package design, resource optimization, enhanced material selection, and source reduction[6]. Education of business colleagues, suppliers, consumers and regulators is also an important vehicle to connect a sustainable packaging strategy to existing market needs.

Collaboration across the packaging supply chain will facilitate understanding, help identify opportunities to improve materials and packaging systems and enable sustainable alternatives to be developed with zero or little additional cost. Experience from other sectors that are starting to embrace the principles of sustainable business indicates that improvements in product quality and profitability are often realized. Other benefits of sustainable packaging include brand enhancement and new sources of materials made available through mechanisms like materials pooling.

Innovative new packaging materials from renewable resources and step change advances in recovery/recycling systems, while still on the horizon for many materials are actively being used in other parts of the world. While there may be costs associated with the transition to new packaging materials or recovery strategies, there will also be savings. Some of these direct savings could include reduced regulatory and tipping fees, and reduced environmental management costs.

C. Sourced, Manufactured, Transported and Recycled using Renewable Energy

i. *Relevance to Sustainable Development*

The wide-scale use of fossil fuels as the primary source of energy is one of the principal factors contributing to many local, regional and global pollution issues including climate change, acidification, ozone depletion, mercury build up, photochemical ozone, and particulates. Renewable energy potentially offers a solution to many of the environmental, social and economic issues central to the development of a sustainable world. The most common types of renewable energy include solar energy (passive and active); windpower; hydroelectric; biomass (biofuels and biopower); tidal energy; and geothermal.

ii. *Relevance to Packaging*

Today most packaging materials and conversion processes rely on fossil fuel-based energy to a greater or lesser extent. The transition from fossil fuels to renewable energy throughout the packaging supply chain will require changes at many levels over a significant timeline. The SPC recognizes that it is not possible, in the short to medium term, to migrate all materials and processes to renewable energy sources and that the rate limiting step will be the availability of a sustainable supply of renewable energy.

iii. *Strategies & Opportunities*

Companies are beginning to address the need to shift to renewable energy through a variety of strategies. In the near term, making fossil-fuel based systems as efficient as possible is an effective strategy for moving toward sustainability with very real economic and environmental return. At the same time, there must be a dedicated effort to diversify the energy mix and build momentum behind the transition to renewable energy. This transition is being encouraged through the direct purchase of renewable energy, through carbon credits, or tradable renewable allowances (TRECS).

Transportation is a significant source of fossil fuel consumption associated with packaging. Companies experience direct cost benefit from improving fleet performance through optimized distribution or better fuel efficiency. Companies are also encouraging the use of bio-based fuels, hybrid vehicles, and innovative technologies through internal measures or by acknowledging the efforts of suppliers. These types of activities help develop markets for renewable energy and offer alternatives to fossil fuel as strategies toward a more sustainable energy future.

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[6] Definition of Source Reduction from U.S. EPA: “Source Reduction refers to any change in the design, manufacture, purchase, or use of materials or products (including packaging) to reduce their amount or toxicity before they become municipal solid waste. Source reduction also refers to the reuse of products or materials.”

D. Maximizes the use of Renewable or Recycled Source Materials

i. Relevance to Sustainable Development

The use of renewable or recycled materials creates sustainable material flows and thus provides materials for future generations.

Using recycled materials (renewable or non-renewable) encourages waste reduction and the conservation of resources. The use of renewable materials reduces dependence on non-renewable resources, uses current solar income to create raw materials (greenhouse gas neutral), and encourages sustainable management of resources.

ii. Relevance to Packaging

The use of renewable or recycled materials supports the development of sustainable packaging by improving its environmental profile and providing a source of future packaging materials. The physical deterioration of some materials through mechanical reprocessing (i.e., recycling) currently poses a limit to effective and economic reutilization of some packaging materials. Many of these limitations are being addressed by innovative technologies.

Under cradle to cradle principles, materials should be recovered through either biological or industrial cycles or both. Many renewable or bio-based materials are suitable for recovery through either mechanism. Materials from non-renewable resources should be recycled. Since the value of these materials cannot be recovered by natural processes, they require a high degree of stewardship throughout their life cycle to ensure that they are recovered and re-used.

Specifiers and designers striving for sustainable packaging should ensure the recyclability of materials, especially if they are made from non-renewable resources. Environmentally preferable procurement and prescriptive regulations regarding the environmental characteristic of packaging are expanding and often incorporate recyclability[7] and recycled content requirements.

iii. Strategies & Opportunities

Recycled or Renewable Source Materials

A key strategy for improving the sustainability of packaging is maximizing the use of renewable and recycled materials. The availability, performance, and price of some renewable or recycled materials affect the feasibility of incorporating them into new packaging designs. Material and technological advances that positively influence these factors for renewable and recycled materials can substantially improve the practicality of their use.

The sourcing of recycled materials is closely linked to end-of-life issues. From experience to date, it is clear that demand for recycled materials and the creation of market pull is a key driver for strengthening the recovery and recycling industry needed to provide them.

Virgin Source Materials

One strategy used to address concerns associated with the production of virgin bio-based packaging materials is sourcing from sustainably managed and certified sources. This tactic is used currently to address forestry and agricultural practices. While there is some focus on the sourcing of non-renewable resources through clean production, there is not a comparable set of well-accepted sustainability practices or certifications directed toward the value chain for the sourcing of non-renewable resources.

[7] The presence of infrastructure to collect and recycle materials is incorporated into some definitions of recyclability. These definitions pose a significant barrier to material innovation as it continues to favor the use of existing materials versus the development of optimized materials that may not currently have infrastructure for collection and recovery.

E. Manufactured using Clean Production Technologies and Best Practices

i. Relevance to Sustainable Development

Clean production refers to the continuous application of "an integrated preventive environmental strategy to increase overall efficiency and reduce risks to humans and the environment." This includes conserving raw materials, water and energy, eliminating toxic and dangerous raw materials, and reducing the quantity and toxicity of all emissions and waste at source during production processes.[8]

ii. Relevance to Packaging

Clean production represents environmentally responsible practice and applies to any industrial activity including the production of packaging. Packaging uses significant quantities of energy, water and materials in manufacturing and production processes. Clean production seeks to reduce and ultimately eliminate the environmental impact of any emissions and toxins emerging from these production processes.

iii. Strategies & Opportunities

Eco-efficiency strategies are currently pursued to minimize emissions, energy use and waste. Some examples include voluntary emission reduction or elimination programs, and the use of cleaner technologies.

Encouraging companies and suppliers to ensure their production processes meet clean production best practice standards, supports responsible manufacturing, worker safety and sustainable packaging. It can also ultimately reduce costs, improve quality and long term profitability.

New approaches and technologies are on the horizon. Advances are being made on closed-loop systems and beneficial reuse to eliminate wastes. Green Chemistry[9] and Green Engineering[10,11] represent encouraging signs that the technical and scientific intelligence that created the technological transformation of the 20th century is now being directed toward solutions to unintended consequences.

F. Made from Materials Healthy in all Probable End-of-Life Scenarios;

i. Relevance to Sustainable Development

Human and ecological health is a basic requirement of sustainable development. Material health is a cradle to cradle principle that addresses the use, presence and release of harmful substances to the environment. The accumulation of problematic substances in the biosphere and in our bodies is the subject of increasing concern for consumers, health professionals and governments.

ii. Relevance to Packaging

Packaging may contain certain chemicals that result in the unintended release of harmful substances during the life cycle of the package, particularly at the end-of-life. While these chemicals are typically utilized in small amounts, the scale and quantity of packaging waste can render them

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[8] United Nations Environmental Programme. Cleaner Production – Key Elements. May 11, 2001. Online. UNEP Production & Consumption Branch, July 22, 2005 *http://www.uneptie.org/pc/cp/understanding_cp/home.htm#definition*

[9] Definition of Green Chemistry: the design of chemical products and processes that reduce or eliminate the use and generation of hazardous substances *http://www.epa.gov/greenchemistry/whats_gc.html*

[10] Definition of Green Engineering: the design, commercialization, and use of processes and products, which are feasible and economical while minimizing 1) generation of pollution at the source and 2) risk to human health and the environment. *http://www.epa.gov/opptintr/greenengineering/index.html*

[11] "Green Engineering transforms existing engineering disciplines and practices to those that promote sustainability. Green Engineering incorporates development and implementation of technologically and economically viable products, processes, and systems that promote human welfare while protecting human health and elevating the protection of the biosphere as a criterion in engineering solutions. *http://enviro.utoledo.edu/Green/SanDestin%20summary.pdf*

significant. Ensuring all ingredients - including additives, inks, adhesives, and coatings - are safe for human and environmental health throughout their life cycle is a vital aspect of sustainable packaging design.

iii. Strategies & Opportunities

Careful selection and specification of the safest materials available to meet the package performance requirements is the preferred strategy. Currently, companies continuously monitor materials bans, restricted substances lists, and legislation prohibiting the use of certain substances within packaging. There is also a need for an ongoing dialog to examine what is in packaging materials and to encourage the optimization of material formulations for human and environmental health. The development of tools and methodologies to assess material health is underway and will allow more transparent communication of material characteristics throughout the value chain.

G. Physically Designed to Optimize Materials and Energy

i. Relevance to Sustainable Development

Seventy percent of the overall impact of a product is determined in the design phase[12]. By thinking about the entire life cycle of a product during the design phase and identifying critical aspects, it is possible to anticipate impacts and eliminate problems and waste up front. For this reason, anticipatory design is a fundamental best practice for sustainable products and packaging.

> *"It is not possible to repeat too often that waste is not something which comes after the fact…picking up and reclaiming scrap left over after production is a public service, but planning so that there will be no scrap is a higher public service."* Henry Ford, 1924

ii. Relevance to Packaging

Typically companies design packaging to meet critical cost, performance and marketing requirements. Sustainable packaging design adds consideration of life cycle impacts including: energy use over the life of the package, impact of materials in end-of-life scenarios and appropriateness of the design/materials to facilitate material recovery. Other factors that should be considered in the design phase are consumer behavior and the variation of established recovery systems by market.

iii. Strategies & Opportunities

Several methodologies are currently used to support sustainable design including, Design for Environment, Design for Disassembly, and Source Reduction. Corporate strategies to address packaging design include developing sustainable design guidelines and embedding them within product development processes. It is important to note that sometimes the adoption of one design strategy over another may result in tradeoffs. One design may focus on minimizing energy impacts over the life of the package and another may focus on the use of recycled content. Internal corporate sustainability objectives may influence the weighting of specific life cycle impacts and thus influence ultimate internal design strategies. In general, sustainable packaging design calls on designers to weigh these factors against each other and optimize their use as a whole. Standardization and communication of sustainable design strategies and their adoption by the packaging industry will create significant advances toward more sustainable packaging.

H. Effectively Recovered and Utilized in Biological and/or Industrial Cradle to Cradle cycles.

i. Relevance to Sustainable Development

Currently, economic expansion and the related growth in resource use are considered to be inconsistent with sustainable development. Creating sustainable flows of materials will reduce the overall use of finite natural resources and minimize waste. Effective recovery means creating the collection and recycling infrastructure necessary to close the loop on materials in order to provide valuable resources for the next generation of production.

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[12] The Natural Step. Design, 2004. Online. The Natural Step, July 22, 2005 <*http://www.naturalstep.org/services/design.php*>

ii. Relevance to Packaging

The greatest challenge to the development of sustainable packaging is the creation of economically viable and effective systems to collect and recover value from materials. The recovery phase of the packaging life cycle is the recipient of the cumulative impacts of all upstream decisions.

Effective recovery implies the significant collection and recovery of material at the highest value that is economically feasible (see Figure 1). As suggested by the discussion under previous criteria, effective recovery can be achieved through supply chain collaboration, by the coordinated efforts of the packaging system to create healthy and recyclable materials, by packaging designed for recovery, and by establishing appropriate collection and recovery infrastructure with the combined support of end users – brand owners, retailers and consumers.

iii. Strategies & Opportunities

There are many methods of collecting and recycling packaging materials to recover their intrinsic value to society. In reality, the established recovery infrastructure in the country in which the product is sold/used, together with market dynamics, will ultimately determine the method through which a package will be recovered. Some of the more common recovery methods are discussed below.

Biological Recovery (Managed Composting)

The earth's biosphere effectively recovers the nutritive value of basic biological materials. The conditions for effective biological degradation do not exist in landfills and the release of problematic substances is a further concern. It is necessary to engineer and manage biological recovery systems to ensure safe and effective recovery of value from biological materials. Managed composting and anaerobic digestion with energy recovery are examples of managed biological recovery systems. Landfills are not.

Technical Recovery (Recycling)

As nature cannot effectively recover many man-made packaging materials, engineered recovery systems are necessary to avoid their accumulation in the environment and to recapture their value. Some examples of technical recovery include mechanical and chemical recycling of plastics and thermal recycling of metals and glass. It is also possible to recover biological materials in technical systems (e.g., paper recycling). The ability to economically recover value varies by material, regional variations in infrastructure and technology, and consumer behavior.

Energy Recovery[13] (Waste to Energy)

Energy recovery is increasingly used as a method to recover value from packaging materials. Safe incineration with energy recovery, waste to energy facilities, and the use of plastic and paper as an alternative fuel are all energy recovery methods. These technologies represent conversion of material to energy.

While energy recovery does not represent a sustainable use of non-renewable packaging materials (e.g., fossil fuel based plastics), it is a preferable interim alternative to landfills, litter, or uncontrolled burning.

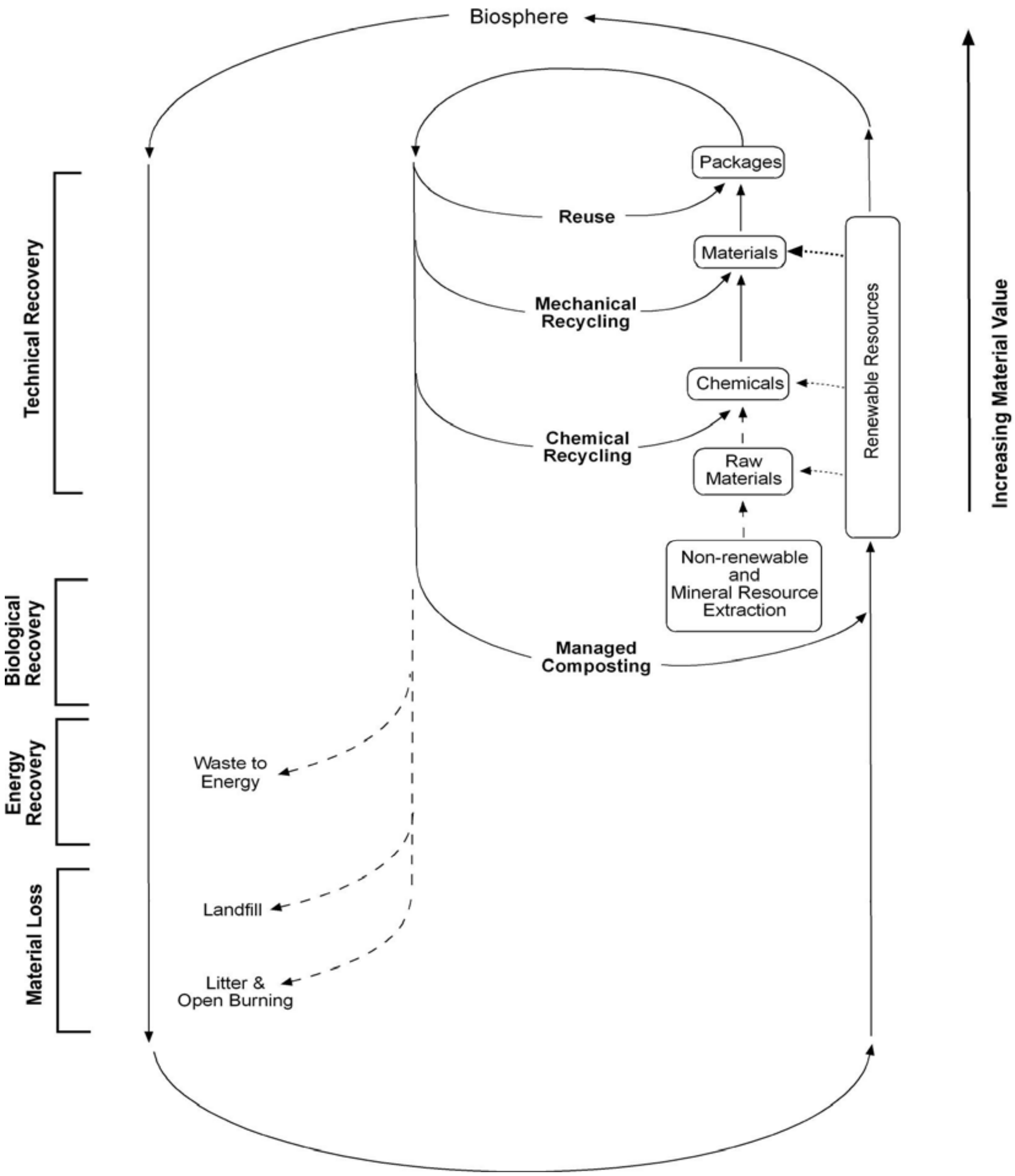
For bio-based materials, energy recovery has different implications. Bio-based materials are a preferred alternative to fossil fuels as they are renewable and are considered carbon neutral with respect to climate change.

The best efforts to meet many of the criteria outlined in this definition (e.g., performance and cost, renewable energy, safe materials, optimally designed packaging) will only result in sustainable packaging if it is collected and recovered. Ideally, materials and recovery options should be introduced at the same time, which requires coordination along the entire value chain.

[13] These comments are only valid for incinerators that do not emit dioxins and other pollutants into the atmosphere (i.e., they are equipped with appropriate waste air scrubbing and cleaning processes. The latter is referred to "safe incineration with energy recovery")

Figure 1.

A Cradle to Cradle Vision for the Recovery of Material Value



This figure represents an idealized vision for cradle to cradle material flows and other possible end-of-life scenarios for packaging. Cradle to cradle principles suggest recovering materials at their highest value when feasible. This figure does not represent a waste management hierarchy.

IV. Resources

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