SUSTAINABLE PACKAGING COALITION®
A PROJECT OF GREENBLUE

Definition of Sustainable Packaging

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I. A Vision for Sustainable Packaging

The Sustainable Packaging Coalition® (SPC), a project of GreenBlue®, 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 closed loop system for all packaging materials.

The mission of the Sustainable Packaging Coalition is to use thorough research and science-based approaches to help advance and communicate a positive, robust environmental vision for packaging and to support innovative, functional packaging materials and systems that promote economic and environmental health.

This document articulates a definition of “sustainable packaging” so the packaging value chain can work toward a common vision. By providing a comprehensive set of criteria that encompasses the systemic nature of sustainability for packaging, this definition also identifies where action can and should be taken by the packaging industry to evaluate current efforts, identify opportunities, and begin to pursue strategies to develop more sustainable packaging materials and systems.

This 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, leading to more sustainable packaging systems.

II. Definition of Sustainable Packaging

The criteria presented here blend broad sustainability and industrial ecology 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 the packaging value chain 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 closed loop flow of packaging materials in a system that is economically robust and provides benefit throughout its life cycle—a sustainable packaging system.

Sustainable packaging[1]:

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. Optimizes the use of renewable or recycled source materials
E. Is manufactured using clean production technologies and best practices
F. Is made from materials healthy throughout the life cycle
G. Is physically designed to optimize materials and energy
H. Is effectively recovered and utilized in biological and/or industrial closed loop cycles

[1] No ranking is implied in the order of criteria.

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 sustainability for packaging.

III. Explanation of Criteria

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

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 strategies, multinational companies have expanded operations overseas and are increasingly being held accountable for actions resulting in negative social or environmental consequences. The emergence of corporate social responsibility and sustainability reports reflect the growing focus on corporate citizenship, accountability, and transparency. Leading companies are implementing holistic sustainability measures that benchmark, measure, and track progress across a wide range of environmental and social impact categories.

Relevance to Packaging
The global packaging industry in 2009 was estimated at $429 billion and employed more than five million people all over the world.[2] 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 foodstuffs. Packaging allows 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.

Strategies & Opportunities
Packaging protects the environmental and economic investment in products and contributes to economic development and social well being by facilitating the distribution and delivery of products to the marketplace. However, after its useful life, packaging contributes to municipal solid waste that is managed at the community level. Effectively managing this waste is a challenge in many communities and especially in emerging or underdeveloped economies. Creating economically viable, closed loop systems for the recovery of packaging materials is an essential characteristic for sustainable materials management.[3] Such a strategy supports individuals and communities through the creation of gainful employment, development of recovery infrastructure, conservation of resources, and measurable improvements in environmental performance. Corporate social responsibility, accountability, and equitable wages are all part of creating a more 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 6.9 billion in 2010 to 9.2 billion by 2050, roughly a 33% 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

[2] “Global Sustainable Packaging Market to Double to $170B by 2014,” *Environmental Leader*, January 5, 2010. http://www.environmentalleader.com/2010/01/05/pike-research-finds-global-sustainable-packaging-market-to-double-by-2014/

[3] Definition of sustainable materials management from OECD: “Sustainable materials management is an approach to promote sustainable materials use, integrating actions targeted at reducing negative environmental impacts and preserving natural capital throughout the life-cycle of materials, taking into account economic efficiency and social equity.” http://www.oecd.org/document/42/0,3746,en_2649_34395_44441642_1_1_1_1,00&&en-USS_01DBC.html

[4] Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. *World Population Prospects: The 2008 Revision and World Urbanization Prospects: The 2008 Revision*, 2010. United Nations. December 17, 2010. http://esa.un.org/UNPP/p2k0data.asp

packaging use has accompanied economic growth. A goal of sustainable packaging is to facilitate economic growth by delivering the benefits of packaged goods without the negative impacts traditionally associated with packaging and related processes.

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 is an element of 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) or environment (e.g., emissions) are being redirected to producers through legislation, levies, and stricter compliance regulations. 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.

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, informed material selection, design for recovery, and source reduction.[6] Education of business colleagues, suppliers, consumers, and regulators is also an important vehicle to connect a packaging strategy for sustainability 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 minimal 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 include brand enhancement and new sources of materials being made available through improved recovery systems.

Innovative new packaging materials from renewable resources and step change advances in recovery/recycling systems, while still on the horizon for many materials, is 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 can also be savings in the form of 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 a primary source of energy in many parts of the world is a principal factor contributing to many local, regional, and global environmental issues including: climate change, acidification, mercury deposition, photochemical ozone, particulates, and severe local impacts due to mining or drilling. Renewable energy potentially offers solutions 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), wind power, hydroelectric, biomass (biofuels and bio-power), 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

[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*

[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."

medium term to migrate all materials and processes to renewable energy sources and that the rate limiting step will largely depend on local availability of a reliable supply of renewable energy and national energy policies. However, a transition to renewable energy is vitally important in those regions that are currently heavily dependent on imported fossil resources for their 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, minimizing the use of fossil fuels and striving for optimal energy efficiency is an effective strategy for moving toward sustainability with very real economic and environmental returns. At the same time, there must be a dedicated effort by companies over the longer term to diversify the energy mix and build momentum behind the transition to renewable energy. This transition can be supported through the direct use or indirect purchase of renewable energy, 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 and better fuel efficiency. Companies are also encouraging the use of alternative 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.

D. Optimizes the Use of Renewable or Recycled Source Materials

i. *Relevance to Sustainable Development*

The use of recycled or bio-based and renewable materials from well-managed sources can contribute to sustainable material flows and help ensure the availability of materials for future generations.

Using recycled materials (bio-based renewable or non-renewable) encourages waste reduction and the conservation of resources. Utilization of post-consumer recovered materials supports an ethic of stewardship, supports the development of markets, and is an essential part of developing near closed loop systems. The use of bio-based renewable materials from well-managed sources reduces dependence on non-renewable resources, uses current photosynthesized carbon to create raw materials that have the potential to be greenhouse gas neutral, and encourages more sustainable management of these resources.

ii. *Relevance to Packaging*

The use of bio-based renewable or recycled materials can support 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., mechanical recycling) currently poses a limit to effective and economic reutilization of some packaging materials. As demand for finite land and material resources grows, innovation related to the recovery and use of recycled packaging materials is likely.

Using principles of industrial ecology, materials should be recovered through either biological or industrial mechanisms, or both, and made available as inputs for new systems of production. Many bio-based and renewable materials are suitable for recovery through either biological or technical means. Materials from non-renewable resources should be recycled to the highest degree possible. Since the value of these materials cannot be recovered through natural processes and may be persistent in the environment, they require a high degree of stewardship throughout their life cycle to ensure that they are collected, 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.

[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.

iii. Strategies & Opportunities

Recycled or Bio-based and Renewable Source Materials

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

The sourcing of recycled materials is closely linked to package design and the effectiveness of recovery systems. It is clear that demand for recycled materials and the creation of end markets is a key driver for strengthening the recovery and recycling industries needed to provide them. The quality of recovered materials is a prime concern to end users and often limits the use of recycled materials in many packaging applications due to concerns over contamination, appearance, or physical performance.

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 to a lesser degree 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 material resources, like oil or minerals.

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 implement environmental practices and technologies to reduce the environmental impact of manufacturing processes including any toxics used or emitted.

iii. Strategies & Opportunities

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

Encouraging companies and suppliers to insure that their production processes meet clean production best practice standards, and meet expectations for responsible manufacturing and worker safety is fundamental to linking manufacturing performance to sustainable packaging. It can also ultimately reduce cost; improve quality and long-term profitability by reducing risks and improving compliance.

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

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[8] United Nations Environmental Programme, "Cleaner Production – Key Elements," May 11, 2001. 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*

encouraging signs that the technical and scientific intelligence that created the technological transformation of the 20th century is now being directed toward identifying solutions for some of the unintended consequences of our industrial systems.

F. Made from Materials Healthy Throughout the Life Cycle

i. *Relevance to Sustainable Development*

Human and ecological health is a basic requirement of sustainable development. Material health is a principle that addresses the presence and release of harmful substances to the environment. Related to clean production, material health extends consideration of the use and emission of substances of concern through the use and end of life phases of packaging. The objective is to identify and minimize or eliminate hazards associated with materials used in packaging along the life cycle. The accumulation of problematic substances in the biosphere and in our bodies is the subject of increasing concern for consumers, health professionals, governments, and companies.

ii. *Relevance to Packaging*

Packaging may use or contain certain chemicals that result in the unintended release of harmful substances during the life cycle of the package. While these chemicals are typically utilized in small amounts, the scale and quantity of packaging and associated wastes can render them 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. All companies should track legislation, material bans, and substances of concern to identify compliance issues and minimize risk. Leading companies have clear restricted substance lists and are identifying alternatives for substances of concern in order to design out hazards where possible and take packaging design beyond compliance towards sustainability. There is also a need for greater transparency regarding 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 ongoing 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 minimize 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

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[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*

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

ii. Relevance to Packaging

Typically a company designs packaging to meet critical cost, performance, marketing, and regulatory requirements. Sustainable design for packaging starts with informed material selection, a clear understanding of performance requirements, and adds consideration of life cycle impacts. These include: energy use over the life of the package, impact of materials in all end-of-life scenarios, and appropriateness of the package design 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 strategies like Design for Recycling, and Source Reduction. Corporate strategies to address packaging design include developing sustainable design guidelines such as the SPC's *Design Guidelines for Sustainable Packaging,* 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, for example, 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 them, while keeping in mind that optimizing for one parameter may shift the environmental burden to another. 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 Closed Loop Cycles.

i. Relevance to Sustainable Development

Economic expansion and the related growth in resource use are 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.

ii. Relevance to Packaging

The greatest challenge to the development of sustainable packaging is the creation of economically viable and effective infrastructure and systems to collect and recover value from materials beyond their initial use. In addition, the recovery phase of the packaging life cycle is the recipient of the cumulative impacts of all upstream decisions, which can make collecting and recovering packaging challenging.

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, consumers, and municipalities.

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 recapture their value and to avoid their accumulation in the environment. 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.

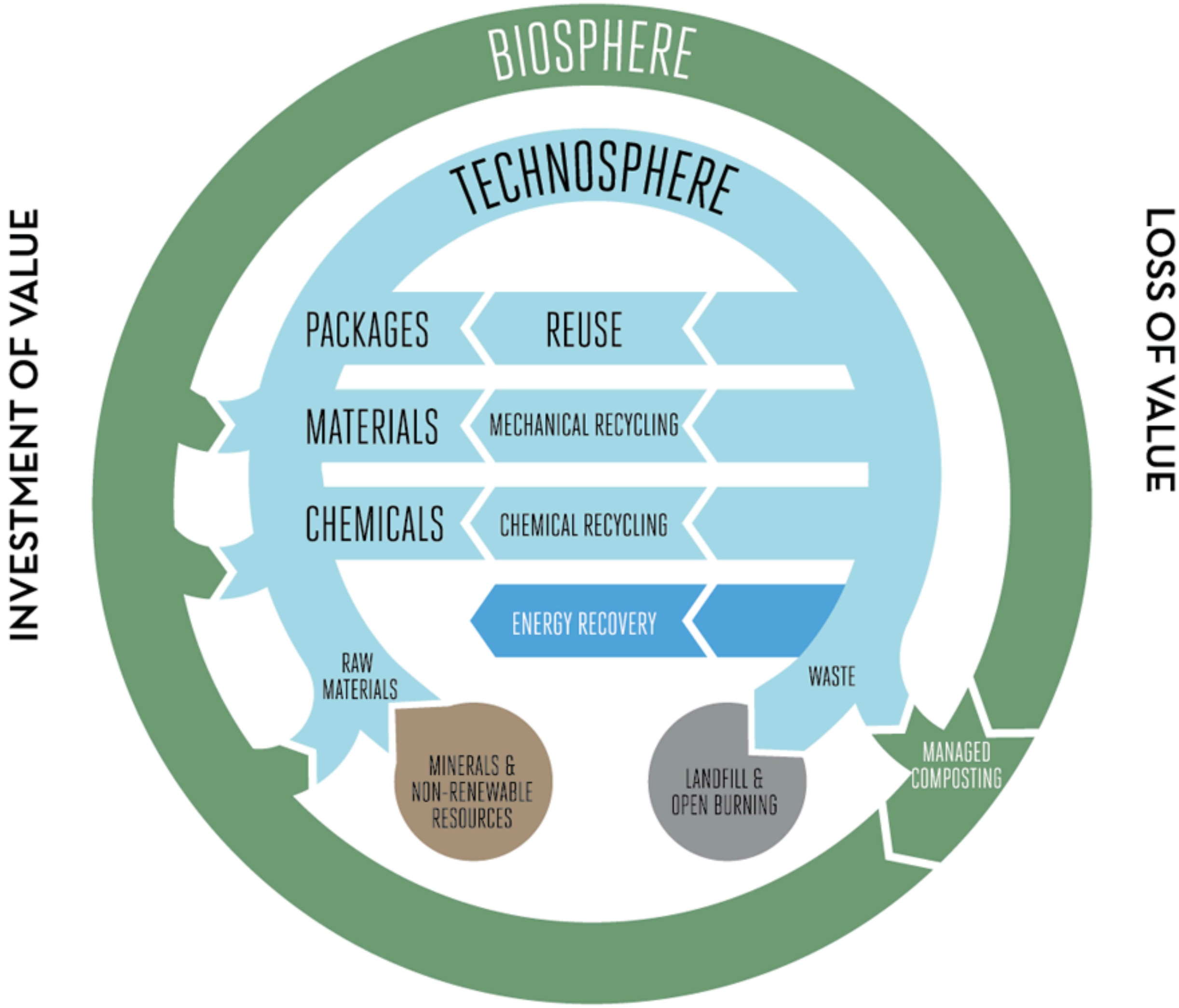
While energy recovery does not represent a sustainable use of non-renewable packaging materials (e.g., fossil fuel based plastics), it is a preferable alternative to landfills, litter, or uncontrolled burning.

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

The best efforts to meet many of the criteria outlined in the SPC definition of sustainable packaging (e.g., performance and cost, renewable energy, safe materials, optimally designed packaging) will only result in sustainable packaging if it is collected and recovered effectively and efficiently. Ideally, when a new material is introduced to the market, clear and accurate communication following FTC guidelines about the material's recovery options, including disclosure of the most likely end of life option and suitability with existing infrastructure, should be made at the same time. This requires thorough understanding of recovery systems and coordination along the entire value chain regarding communication.

[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. Closing the Loop on Recovering Material Value



This figure represents an idealized vision for closed loop material flows and other possible end-of-life scenarios for packaging. Principles of industrial ecology suggest recovering materials at their highest value when feasible. This figure does not represent a waste management hierarchy.

IV. Resources

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