Special Report 1

Boosting the Spread of Sustainable Packaging

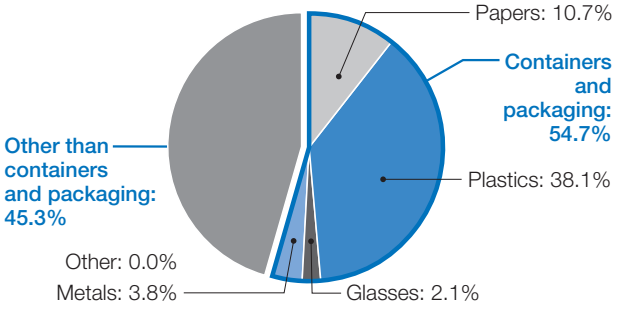
Containers and packaging are indispensable in daily life. The Toppan Group is making them sustainable in collaborative partnerships with stakeholders throughout the value chain.

The Various Roles of Containers and Packaging

Containers and packaging are used in daily life for wide-ranging functions. One major role is to protect packaged products against the external environment. Others include the packaging of products conveniently in smaller portions to make them easy to carry or sell and the display of information on product usage or precautions.

Despite their manifold functions, containers and packaging must be disposed of as waste once the products they contain are used or consumed. Broad sections of society, therefore, require manufacturers to develop containers and packaging that minimize their impacts on the global environment without sacrificing safety or convenience.

■ **Containers and Packaging Account for 54.7% of the Volume of All Household Waste**



Source: Study on the Use and Discharge of Containers and Packaging 2016 from Japan's Ministry of the Environment

Containers and packaging are also helping to reduce food loss, a form of waste that has been drawing significant attention in recent years. They can preserve freshness for longer periods and extend best-before dates thanks to a combination of container and packaging technology with food processing technology. Small portions and individual packages, meanwhile, allow consumers to purchase and use only the amounts they need.

The Global Challenge of Reducing the Environmental Burden of Containers and Packaging

The European Union (EU) now places a new model called the "circular economy" at the core of its growth strategy. The Circular Economy Package adopted by the European Commission in December 2015 is a collection of major action plans to achieve the circular economy. Five priority areas are assigned: plastics, food waste, critical raw materials, construction and demolition, and biomass and bio-based materials. The EU is calling on each member state to set targets and develop necessary legislation for implementation towards the fulfillment of the goals.

■ **EU Waste Reduction Targets in Circular Economy Package**

- Recycle 65% of municipal waste by 2030
- Recycle 75% of packaging waste by 2030
- Reduce landfill to a maximum of 10% of municipal waste by 2030

Source: Press release issued by the European Commission

Toppan's Vision for Sustainable Packaging

Containers and Packaging for a Sustainable Society

Toppan has a vision for containers and packaging. At the very least, they must serve all necessary functions expected of packaging without using materials in excessive volumes or of unduly high quality for the products being packaged. Toppan's ideal containers and packaging also ensure safety and security for every user and reduce environmental burden to the minimum possible levels. Toppan is confident that targeting such containers and packaging will contribute to the creation of a sustainable society.

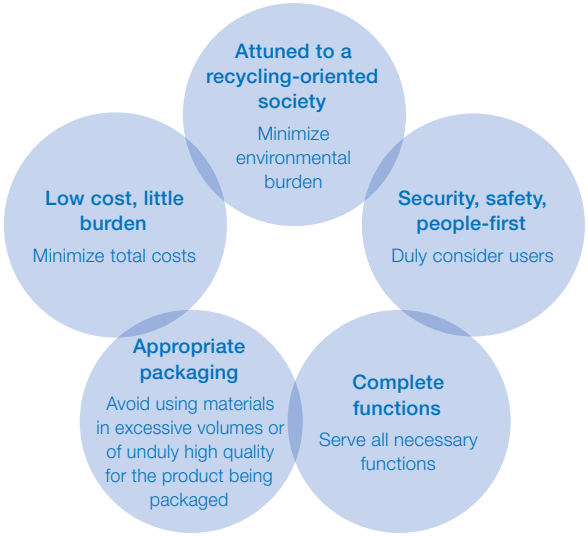
Sustainable Packaging: A Scheme to Make the Finite Infinite

Packaging optimization—the process of maintaining and improving packaging functions while reducing raw materials consumed—has been a global issue in recent years. Toppan continues tracking this international trend and developing proposals for sustainable packaging based on the Group's own guidelines in line with the concepts of the ISO 18600 series standards on Packaging and the Environment.

The Group proposes packaging designs optimized to the entire lifecycles of products marketed by customer companies. Quality preservation and water and energy consumption during use are carefully controlled with no sacrifice of packaging functions through excessive reductions of packaging weight. In designing sustainable packaging, the Group also pursues the effective use of inexhaustible and recycled resources and the sustainable use of forest resources for the procurement of paper. The Toppan Group designates these policies as the Guidelines for Environmentally Friendly Packaging and offers eco-packaging proposals accordingly.

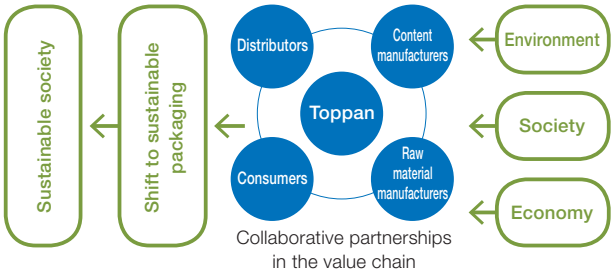
Sustainable packaging at this level can be achieved only through cooperation with various stakeholders in the value chain. Outside the scope of design and production, Toppan is organically linking manufacturers, distributors, consumers, and other stakeholders to facilitate the shift to sustainable packaging in terms of products and systems. The Group will remain dedicated to the creation of a sustainable society by building up and refining its efforts to make the finite infinite.

■ Vision for Containers and Packaging



Source: Japan Packaging Institute

■ Toppan's Vision for Sustainable Packaging



Collaborative partnerships in the value chain

■ Guidelines for Environmentally Friendly Packaging

❶ Design encompassing the entire lifecycle of products

Packaging optimization	Optimize design focused on quality preservation, energy consumption, etc. during use without sacrificing packaging functions through excessive reductions of weight
Reduce, replace Reuse, recycle	Promote 4R design of packaging to encourage the effective use of resources

❷ Use of sustainable resources

Use of biomass resources Effective use of recycled resources Use of properly procured paper	Propose packaging focused on the effective use of inexhaustible and recycled resources and the sustainable use of forest resources

Evaluate environmental burden by life-cycle assessment (LCA) methods

Technologies and Innovations for Sustainable Packaging

GL BARRIER: A World-class Transparent Barrier Film

Each year, about 1.3 billion tons of unconsumed food—leftovers, food past its consume-by date, etc.—goes to waste on our planet. Toppan harnesses its packaging expertise to combat the global challenge of reducing food waste.

GL BARRIER, a transparent barrier film from Toppan, offers world-class barrier performance in food packaging rivaling that of aluminum foil. The film protects packaged food from degradation due to oxygen, aridity, and moisture, enabling longer periods of quality-preserving storage compared to containers lined with other protective materials. While the prolonged storage periods reduce material procurement costs and inventory-related loss, the streamlined layer structure lightens the packaging weight, which lowers energy consumption in transportation.

In April 2016, Toppan completed a new plant in the U.S. State of Georgia in anticipation of growing demand for transparent barrier films. By supplying films directly to North American and European packaging manufacturers, the U.S. plant will lower transportation costs and guarantee a steady supply of the transparent barrier films.

A film suitable for printing, lamination, and other treatments, developed with Toppan's original coating and clear vapor deposition technologies

Mechanically Recycled PET Film: A PET Film Produced from Used PET Bottles

Mechanical recycling is a method to obtain a high-quality reproduced resin by eliminating impurities from a recycled material through the cleaning and crushing of used polyethylene terephthalate (PET) bottles followed by high-temperature, reduced-pressure treatment for a given length of time.

Toppan calls the PET film it produces from mechanically recycled PET resins "mechanically recycled PET film." The film is now applied as a printing base or as a barrier material for various pouches.

Mechanically recycled PET film is composed of 80% recycled resin, a percentage unsurpassed in almost any other recycled PET film ever made. The film matches the transparency and other physical properties of conventional petroleum-based PET films but emits about 24% less CO_2 in the pre-manufacturing stage. Assessments based on the guidelines from the Ministry of Health, Labour and Welfare of Japan verify that mechanically recycled PET film satisfies performance levels of quality and safety required for use in food packaging.

GL-AR-NF, one of the GL BARRIER films developed by Toppan. A mechanically recycled PET film is used as the substrate of this transparent barrier film for use in retort pouches.

BIOAXX®: Packaging Series Using Biomass-based Plastics

Biomass-based plastic is a packaging material made from renewable plant-derived resources instead of exhaustible fossil resources. The absorption of atmospheric CO_2 during plant growth is estimated to offset any CO_2 emissions from incineration of the packaging.

Toppan has been developing and commercializing packaging composed of biomass-based plastics since 1991, including BIOAXX®, a series of laminated packaging materials made from plant-derived raw materials. Toppan developed a biomass polyethylene (PE) film with a thickness of less than 40μm in 2012. This material is adaptable for the flexible packaging of sundry products from non-food products to foods and medicines.

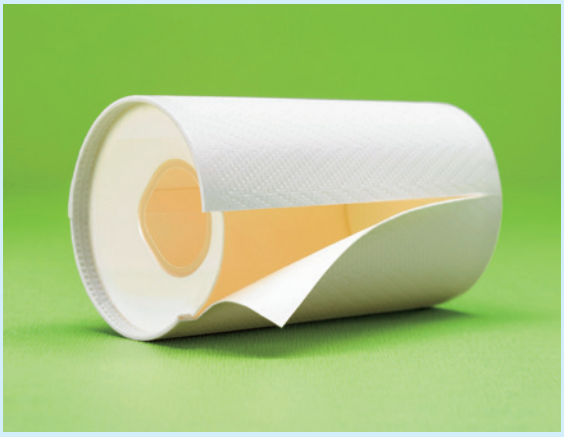
Adaptable for sundry products from stand-up refill pouches for toiletries to foods, medicines, and paper cups

Cartocan®: A Paper-based Beverage Container Produced with Lumber Harvested from Forest-thinning Operations

In pursuing the environmentally responsible use of paper, society expects businesses to principally use pulp derived from recycled paper. When a business uses virgin pulp, the desired choices are environmentally friendly paper such as forest-certified paper, tree-free paper, or paper made from pulp derived from lumber harvested from thinning or other forest maintenance operations. The Toppan Group established Paper Procurement Guidelines for the Sustainable Use of Forest Resources in September 2011.

Cartocan®, Toppan's paper-based beverage container, was placed on the market in 1996. The container uses GL BARRIER, Toppan's original transparent barrier film, and is produced from pulp derived from at least 30% lumber from Japanese forests, including lumber from forest-thinning operations. The assertive use of domestic lumber promotes forestal cycles and sounder forest nurturing across Japan.

Toppan donates some of the proceeds from Cartocan® container purchases by beverage manufacturers to the Green Fund, a program that funds volunteer organizations involved in forest maintenance throughout Japan. Cartocan® is also collectable through the same recycling routes as beverage cartons and can be recycled into toilet paper.



Aseptic filling enables the shipping and storage of Cartocan® at room temperature and sales through various channels such as mail order and vending machines