WHITEPAPER

REUSABLE PACKAGING

KNAUF INDUSTRIES

July 2023

FOREWORD

It all started in 2017, when we were keen to create, pilot and manage new product ranges.

Our goal: to find THE product range that would satisfy all of our 2,000 customers. A huge challenge!

After careful analysis and reflection, all our customers had one need in common: logistics, but specifically ease of handling and storage.

From this starting point, we began to think about **creating a complete range of products from scratch**: creating new products, new brands, structure, coherence, and harmony. Not forgetting tailored training courses and sales pitches to bring our colleagues, our group and the global market with us in this great project.

The name? **ISymoov®**! A name that suggests light, easy movement. An umbrella brand that allows us to position ourselves as experts in light material handling, best represented by its logo, a gorilla being lifted by a balloon, combining the concepts of strength, determination, uniqueness, nature (the gorilla) and lightness (the balloon).

In the age of «Plastic Bashing», we wanted to create a lightweight, durable, and eco-friendly plastic tray. In a nutshell: **the lightest reusable tray on the market KOMEBAC®**.

Komebac® is a play on words to represent the idea of «Reverse Logistics».

Recycling is great, but reusing is even better! Our Komebac® products offer a wide range of solutions to environmental, industrial and, above all, human issues in the logistics and distribution market.

Our customers have several choices when it comes to reusable packaging. How do you choose the right reusable tray for your project? What are the advantages and disadvantages of cardboard? Injected plastic containers? An expanded polypropylene tray? These are just some of the things you might ask yourself when it comes to packaging and transporting your technical or fragile components.

So, in this white paper, you will find a comparison of these 3 technologies to help you select the best solution for your project.

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BACKGROUND

THE CONTEXT OF THE STUDY

00

I. Introduction

Tray, crate, container, packaging, reusable packaging, returnable packaging, galia container, shuttle crate... These are just some of the terms used to talk about reusable packaging. But what is reusable packaging?

Reusable packaging is packaging designed to transport products between different points in a supply or distribution chain.

Unlike disposable packaging, which is used once and then thrown away, reusable packaging can be used several times before being used for something else or recycled.

Reusable packaging is used in many sectors, including agri-food, logistics, manufacturing, automotive and aeronautics.

It can be made from a range of materials, such as wood, metal, plastic, or cardboard.

In today's industrial packaging market, the available packaging solutions can be grouped into four different categories:

- **Standard packaging**: packaging with standardised dimensions (dimensions used by almost all manufacturers).
- **Custom packaging**: «tailor-made» packaging designed to meet the customer's specific needs.
- **Primary (CU) packaging**: this is the container that comes into direct contact with the product, also known as consumption-unit (CU) packaging. This packaging is designed to contain, preserve, and protect the finished product, particularly against dirt or contaminants. It is the first layer that packages the finished product, such as a plastic bag containing wholegrain cereal or the cardboard box containing the cereal bag. This type of packaging is often intended for the end user or consumer. Not only does it make products easier for consumers to handle, but it also aims to make the product more attractive and provides a printing medium for displaying product information.
- **Secondary (HU) packaging**: also called handling-unit (HU) packaging, this is used to group together large quantities of products and transport them from point A (e.g., the factory) to point B (e.g., the point of sale). This is essentially the format used for distribution. This type of packaging helps to transport large, heavy loads so that they can be delivered safely. It prevents damage to the product and makes handling, storing, and transporting goods easier.

Reusable packaging can be made from a variety of materials, including wood, expanded polypropylene, injected plastic, cardboard, and metal. In this study, we decided to compare injected plastic containers, expanded polypropylene containers and cardboard.

KOMEBAC® EPP
595 X 395 X 330

PLASTIC TRAY
600 X 400 X 300

CARDBOARD BOX
600 X 400 X 300

Our goal is to promote the use of documented reusable plastic packaging in order to reduce overall levels of plastic waste by advocating for a fair regulatory framework for secondary packaging.

II. Importance of Reusable Packaging

The advantages of using reusable packaging

The benefits for companies using reusable packaging include:

- **Reduced packaging costs**: reusable packaging is obviously designed to be reused several times, reducing packaging costs in the long term.
- **Waste reduction**: unlike disposable packaging, reusable packaging does not get thrown away immediately, which reduces the amount of waste generated by the business.
- **Supply chain optimisation**: Reusable containers are often designed to fit automated handling equipment, reducing downtime, and optimising the supply chain.
- **Product protection:** reusable packaging is often designed to offer greater protection to the products being transported, reducing the risk of damage or loss.
- **Improved sustainability**: reusable packaging can be made from sustainable materials such as wood, metal, or bioplastics, helping to reduce the company's environmental impact.

Ultimately, the use of reusable packaging can help companies cut costs, improve sustainability, and optimise their supply chain while reducing their environmental impact.

The different types of reusable packaging

Here are some examples of reusable packaging currently used in industry:

- **Trays and boxes**: handling trays are mainly used to transport small and medium-sized products (spare parts or small objects), fragile products and products with high added value.
- **Pallets**: pallets are used as handling supports for transporting different types of light or heavy products in bulk. They are mainly made of wood but can also be made of cardboard or plastic (expanded polystyrene or injected plastic).
- **Pallet crates**: pallet crates are boxes that can be handled by a forklift.
- **Foldable containers**: foldable containers are designed to be folded up when not in use, so they take up less space when they are returned to storage empty.

III. Materials Used for Reusable Packaging

Here are a few examples of materials commonly used to manufacture reusable packaging:

- **Wood:** wooden pallets and crates are very common in industry as they are robust, durable, and relatively inexpensive. Wood can also be easily recycled or reused.
- **Metal**: metal containers and crates are also well-known in industry as they are very strong and can withstand heavy loads. Metal is also easy to recycle.
- **Plastic (expanded polypropylene or injected plastic)**: plastic reusable packaging is lightweight, durable, and water-resistant, making it ideal for use in damp or corrosive environments. Plastic can also be recycled.
- **Cardboard**: cardboard crates and boxes are often used to transport lighter or more fragile products. Cardboard is inexpensive, easily recyclable and can be printed with tracking information.
- **Bioplastics**: plastic reusable packaging is light, strong, and easy to wash, making it essential for sustainable logistics flows. Bioplastics can be recycled at the end of their life.

The materials used to manufacture reusable packaging can vary according to the needs and requirements of each company. But in almost all cases, they will need to be durable, resistant, and suitable for the load and environment in which they will be used.

IV. Environmental Issues

Reusable packaging can have both a positive and negative impact on the environment, depending on the materials used, the lifespan of the packaging and how it is handled at the end of its life. These potential environmental impacts include:

- **Greenhouse gas emissions**: the production, transport and waste management of reusable packaging can emit greenhouse gases which contribute to climate change. Emissions can vary depending on the materials used and the distances travelled.
- **Consumption of natural resources**: producing reusable packaging requires the use of natural resources such as water, energy, and raw materials. Some materials can be more resource-efficient than others.
- **Pollution**: certain types of reusable packaging can cause air, water, or soil pollution, particularly if the materials used are not properly disposed of at the end of their life.
- **Waste management**: reusable packaging can become waste at the end of its useful life. If this waste is disposed of in a landfill or incinerator, this can have a negative impact on the environment.
- **Resource conservation:** reusable packaging can also have a positive environmental impact by reducing the overall number of materials needed to transport and store products.

The environmental impact of reusable packaging depends on many factors, including the **materials used, the lifespan of the packaging and how it is disposed of at the end of its life**. Companies can minimise these impacts by choosing sustainable materials and managing waste correctly.

Solutions to reduce the environmental impact of reusable packaging

Here are a few examples:

- Use circular, sustainable and resource-efficient materials for reusable packaging, such as certified wood, bioplastics, or recycled materials.
- Reduce the quantity of materials used to design lighter, smaller reusable packaging.
- Encourage reuse by setting up collection and refurbishment systems to extend the life of reusable packaging and reduce the demand for new materials.
- Encourage recycling by setting up dedicated channels for processing reusable packaging at the end of its useful life and encourage their partners to participate. The aim is to reduce both the amount of waste sent to landfill and the demand for new materials.

COMPARATIVE STUDY

USING AN EPP TRAY
VS OTHER TECHNOLOGIES

01

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01. TECHNICAL COMPARISON

GENERAL TECHNICAL CHARACTERISTICS	EPP Tray (Komebac® 64 Fond 330) 595 x 395 x 330	Plastic Tray 596 x 396 x 314	Cardboard Box (e.g., GALIA A9)
Purchase price	10,00 €	9,50 €	2,00 €
Accounting depreciation?	YES	YES	NO
Interior dimensions	555 x 355 x 300	559 x 361 x 296	590 x 400 x 275
Useful volume (%)	76%	81%	95%
Payload (% based on a maximum of 10 kg)	85%	70%	92%
Wall thickness	20 mm	18,5 mm	3 mm
Service life (theoretical / observed)	15 / 10 years	20 ans / 15 years	Single use
Suitable for a humid environment	YES	YES	Risk of deterioration
Customisation	Dimensions, inserts Logo+Marking	Simple text	Dimensions Logo+Marking
Cost of customisation	Avarage	High	Low
Composition	6 % material + 94 % air	100% material	70% material + 30% air
Mould required for production?	YES	YES	NO

ERGONOMIC CHARACTERISTICS	EPP Tray (Komebac® 64 Fond 330) 595 x 395 x 330	Plastic Tray 596 x 396 x 314	Cardboard Box (e.g., GALIA A9)
Weight	1 kg	2,960 kg	0,793 Kg
Loading capacity (10 kg ergonomic limit) Payload	44 items weighing 200 g 8,8 kg	35 items weighing 200 g 7,0 kg	46 articles de 200 g 9,2 kg
Total mass of packaging lifted for 1500 CUs handled per day over one year	355 tonnes	976 tonnes	261 tonnes
Gripping system (handle)	YES	YES	NO
Limitation of workshop noise due to replenishing and handling	No resonance	High resonance	No resonance
Handling associated with the removal of empty packaging	Placed on a pallet for transfer to the return or storage area	Placed on a pallet for transfer to the return or storage area	Disposed in a bin. Compact the waste and dispose of it (total cost €1/carton)
Total handling time dedicated to opening the packaging over 1 year (220 working days), in hours, for 1500 CU	0	0	1195.7 HOURS (13 seconds / CPU) i.e., 0.91 FTE = 1 operator

ENVIRONMENTAL CHARACTERISTICS	EPP Tray (Komebac® 64 Fond 330) 595 x 395 x 330	Plastic Tray 596 x 396 x 314	Cardboard Box (e.g., GALIA A9)
Recycled material (%)	40%	70%	90%
Recyclability of materials	Indefinitely	Indefinitely	6 times
Quantity of material discarded over 5 years of use in tonnes (Daily consumption 1500 CU, 230 working days)	0	0	230 T
Biodegradable?	NO	NO	2 months
Meets the expectations for logistics CSR	YES	YES	NO

SAFETY CHARACTERISTICS	EPP Tray (Komebac® 64 Fond 330) 595 x 395 x 330	Plastic Tray 596 x 396 x 314	Cardboard Box (e.g., GALIA A9)
Abrasive material?	NO	NO	YES
Generates dust?	NO	NO	YES
Opening direction	1 side	1 side	2 sides (No secure base)
Risk of packaging breakage during handling	LOW	NO	YES
Product degradability	Breakable	-	Tearable
Risk when opening	-	-	Yes, if using a cutter or if opening on wrong side
Subject to regulatory storage conditions	YES	-	-
Combustion risk	Flammable with release of toxic gas	Flammable with release of toxic gas	Flammable

LOGISTICAL CHARACTERISTICS	EPP Tray (Komebac® 64 Fond 330) 595 x 395 x 330	Plastic Tray 596 x 396 x 314	Cardboard Box (e.g., GALIA A9)
Storage constraints (interior / exterior, stackability, etc.)	Indoors or under cover 4-level stacking	Indoors or under cover 4-level stacking	Indoors only 2-level stacking
Shock absorption	Highly absorbent	Not absorbent	Absorbent
Crush resistance	Resistant	Highly resistant	Resistant
Use in logistics loops	Small and medium loop	Small and medium loop	Any distance
Suitable for automated stacker cranes	YES	YES	Difficult
Ability to stack and self-lock for greater stability	Stackable and self-locking	Stackable and self-locking	Stackable
Nestable or foldable when empty (optional)	YES	YES	-
Pallet wrapping required	NO	NO	YES

02. Compressive Strength

Test conditions in accordance with EN ISO 2233



Physical properties	Test method	KOMEBAC® EPP 595 X 395 X 330	PLASTIC TRAY 600 X 400 X 300	CARDBOARD BOX 600 X 400 X 300
Useful volume	/	59	60	66
Wall thickness	/	20	17	5
Compressive strength	ISO 844 Speed: 5 mm/min	800	-	436
Resistance to maximum load	/	700	600	350

03. OVERALL ASSESSMENT

This table shows the performance of each material according to its properties. For a more accurate assessment, it would be interesting to perform joint tests on equivalent types of packaging.

Material	Format (mm)	Compressive Strength	Bending resistance	Tensile strength	Field compression
Cardboard	600 x 400 x 300				
EPP	595 x 395 x 330				
Plastic	600 x 400 x 300				

 **Much less resistant**

 **Less resistant**

 **Resistant**

 **Highly resistant**

04. COMPARISON BY SECTOR

	EPP Tray	Plastic Tray	Cardboard	Automobile	Agri-food (dry and fresh)	Electronics	Luxury Cosmetics
Can be adapted to the shape and weight of the part (Adjust the product as required, e.g., Galia standard)	x	-	x	x	x	x	x
Pest resistant	x	x	-	-	x	-	-
Thermal insulation	x	-	-	-	x	-	x
ESD treatment	x	x	-	x	-	x	-
Suitable for bulk loading (cereals, hardware, etc.)	x	x	-	x	x	-	x
Can be used with a cleaning and sterilisation system	x	x	-	-	x	x	x
Dust generator in sheltered workshops	-	-	x	-	x	x	x
Integrated Trackers (traceability, temperature control, etc.)	x	x	-	x	x	x	x

	EPP Tray	Plastic Tray	Cardboard	Automobile	Agri-food (dry and fresh)	Electronics	Luxury Cosmetics
Foldable (depending on model) **to optimise return loops**	x	x	-	x	x	x	x
Corrosion-resistant	x	x	x	x	-	x	-
Need to close packaging to ensure stackability	-	-	x	x	x	x	x
Smooth exterior walls for easy cleaning and to limit bacteria, dust, etc.	x	-	-	x	x	x	x
Allows labels to be fixed without glue	x	x	-	x	x	x	x
Single lid to secure and seal the packaging	x	-	-	x	x	x	x

05. EXAMPLES OF USES AND RELATED BENEFITS

Ergonomic benefits

Assumption: the operator can handle and lift a packaging unit (CU) weighing up to 10 kg.
In the following example, we compare using a plastic tray (2.96 kg) and an EPP tray (1 kg) to pack 100,000 items weighing 0.2 kg each.

- Example: A standard plastic tray and an EPP tray (see technical specifications on pages 4 to 8) are used to pack 100,000 parts requiring no special protection and weighing 200g.

Example results

	EPP Tray (Komebac® 64 Fond 330) 595 x 395 x 330	Plastic Tray 596 x 396 x 314	Difference EPP Tray - Plastic Tray
No. of trays used (EPP 44 items / tray; Plast. 35 items / tray)	2 223 trays	2 857 trays	**- 634 trays**
Total weight handled (weight of full tray: EPP = 10 kg; Plast.= 10 kg)	22 320 kg	28 456 kg	**- 6 226 kg**

Important info!
MSDs account for 87% of occupational illnesses and back pain accounts for 20% of accidents at work. In 2017, their direct cost companies almost two billion euros.

Ecological benefits

Sustainable, reusable packaging = less waste.

- Example of use over a period of 15 years (average lifespan of a reusable bin) and considering that one year represents 220 working days.

	EPP Tray (Komebac® 64 Fond 330) 595 x 395 x 330	Plastic Tray 596 x 396 x 314	Cardboard Box (e.g., GALIA A9)
Packaging weight	1 kg	2,960 kg	0,793 kg
Required no. of trays for a logistics loop or boxes for a flow of simple logistics flow over the given period	8,000 trays	12,000 trays	4,304,355 boxes
Total waste generated over the period (in T)	0 T	0 T	3413,4 T
Total recycled waste generated (in T)	0 T	0 T	568,9 T
Total recyclable waste	8 T	35,5 T	0 T

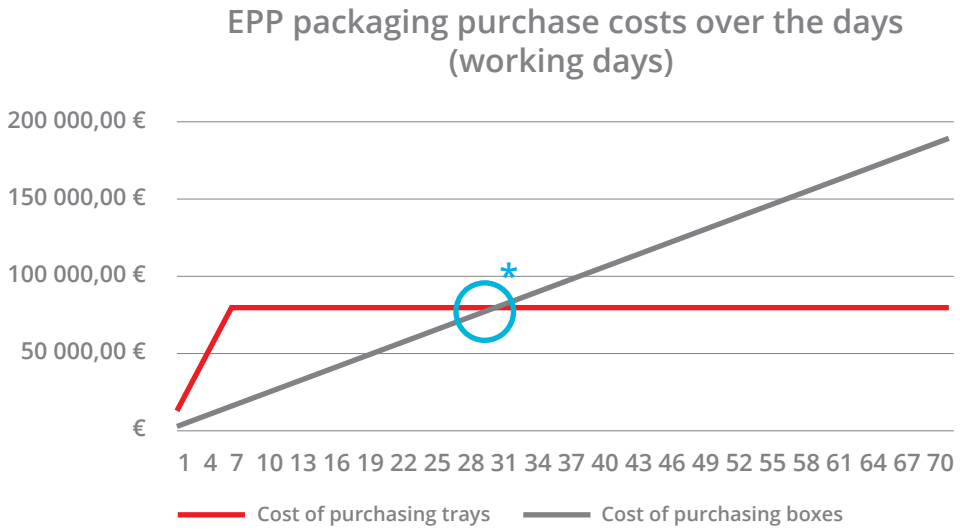
Important info!

In 2020, Knauf Industries set up a collection and recycling programme in France for expanded polystyrene: Knauf Circular (www.knaufcircular.fr)

Financial benefits

Sustainable packaging = a one-off investment that pays off in the short/medium term.

- *Example of use:*
  Annual requirements: 286,957 boxes / 8,000 EPP trays (7-day loop) / 12,000 plastic trays (7-day loop)
  Supplier: located 250 km away and making deliveries once a week



Using cardboard:
Annual purchase: €574k

Using EPP trays:
Investment: €80k
Annual transport cost (1 full load / week): €14k

After the 32nd day (*), the cost of using cardboard boxes exceeds the cost of EPP trays, giving an ROI of less than 2 months!

06. TRENDS AND OUTLOOK

	EPP Trays	Plastic Trays	Cardboard boxes
Market Outlook	Knauf Industries' aims to establish itself as expert in lightweight handling solutions by promoting **its lightweight, reusable Komebac® (ISymoov®) containers**. Knauf Industries wants to offer the market lightweight, reusable, 100% recyclable handling solutions made from recycled materials to allow their customers to reduce their carbon footprint, improve conditions for operators by reducing RSI and enable more sustainable logistics by promoting reuse rather than single use.	"While the plastic bashing rages on, professionals in the sector are working hard to innovate and comply with regulatory developments." Creation of plastics based on recycled or bio-sourced materials (integration of natural materials into existing packaging, etc.). Many innovations and projects launched by manufacturers and research centres. Plastic is not going without a fight and remains essential to the functioning of our economy.	Highly used in warehouses, particularly due to the continuing growth in e-commerce. The COPACEL union stresses that, beyond the economic uncertainties, paper, and cardboard packaging is becoming increasingly popular with consumers and manufacturers alike. This appeal is mainly due to environmental reasons (biodegradability, recycling, etc.). Trending towards more environmentally-friendly materials (e.g., compostable materials).

COMPARATIVE

STUDY

SAFETY AND STORAGE

02

CONTENTS

01. OBJECTIVE

To study the safety and storage rules for 3 different packaging materials (Plastic, cardboard and EPP), to support KNAUF's sales pitch.

This study will define the various rules to be followed, particularly when a fire breaks out in a storage warehouse, including its environmental and human consequences.

KOMEBAC® EPP

PLASTIC TRAY

CARDBOARD BOX

02. FIRE AND ITS CONSEQUENCES

During combustion, the materials react in different ways, and the environmental and human consequences will also be different.

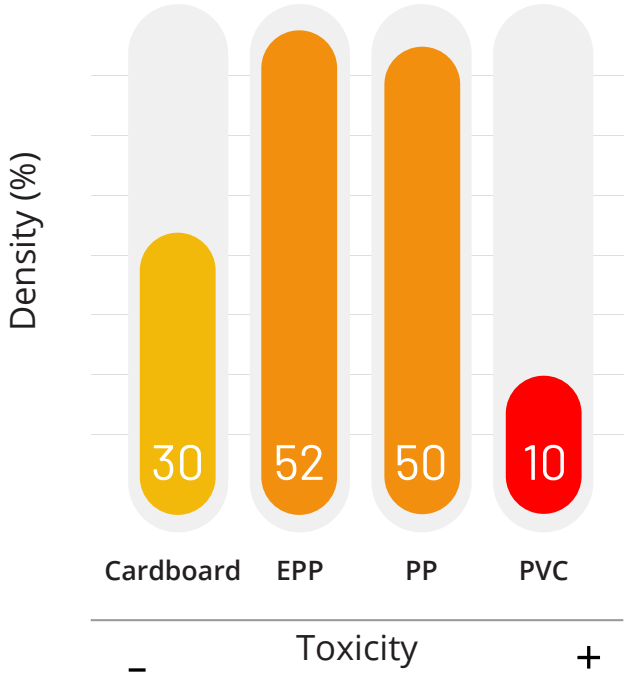
Toxic gases released

Material subject to combustion	Composition	Toxic gas released
Cardboard / Paper	Cellulose C6H10O5 (paper pulp) C: carbon H: hydrogen	**Carbon dioxide (CO_2)** **Carbon monoxide (CO)**
Polyethylene (PE) **Polypropylene** (PP)	**C: carbon** **H: hydrogène**	**Carbon dioxide (CO_2)** **Carbon monoxide (CO)**
Polyvinyl chloride (PVC)	C: carbon H: hydrogen Cl: Chlorine	**Carbon dioxide (CO_2)** **Carbon monoxide (CO)** **Hydrochloric acid (HCl)**
EPP	C: carbon H: hydrogen	**Carbon dioxide (CO_2)** **Carbon monoxide (CO)**

Composition of combustion fumes

Plastic Material	Reactions at different temperatures	Reaction in the event of combustion
Polyethylene (PE)	From 200°C: - Methane, ethylene, butene - Ketones - Aldehydes - Volatile fatty acids	**Carbon monoxide** **Carbon dioxide** **Aliphatic hydrocarbons**
Polypropylene (PP)	From 200°C - 250°C: - Aliphatic hydrocarbons - Aldehydes - Ketones - Volatile fatty acids	**Carbon monoxide** **Carbon dioxide** **Aliphatic hydrocarbons**
Polyvinyl chloride (PVC)	From 175°C - 200°C: - Hydrogen chloride - Aliphatic hydrocarbons - Residual vinyl chloride - Aldehydes	**Monoxyde de carbone** **Dioxyde de carbone** **Hydrocarbure aliphatiques** **Hydrochloric acid**
EPP	From 250°C: - Aromatic hydrocarbons - Nitriles - Aldehydes	**Carbon monoxide** **Carbon dioxide** **Aliphatic hydrocarbons**

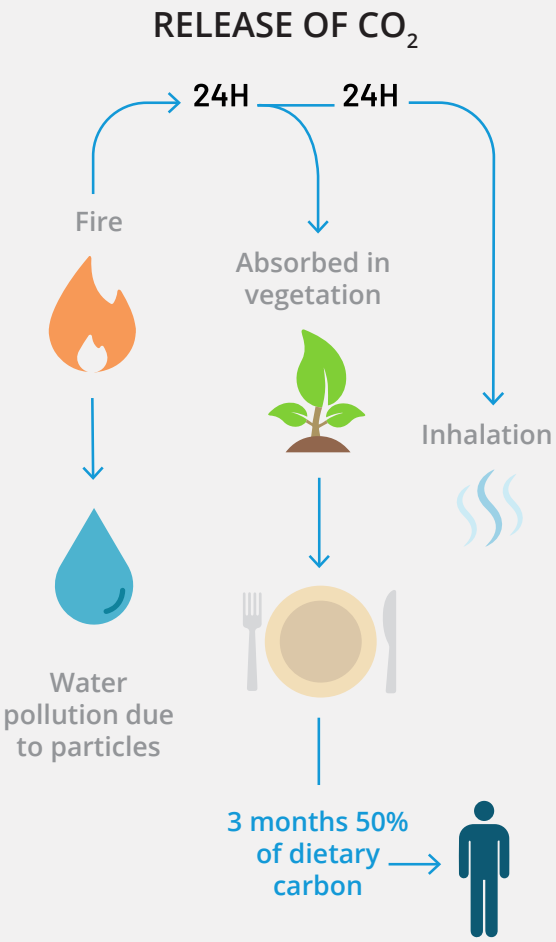
Density and toxicity of combustion fumes in %



Environmental impact of a fire

Fires pollute land and water, releasing toxic gases and particles.

Material	Consequences
EPP	As it is made up of only 5% solid material, it will release less CO_2 and have less impact on the environment.
Cardboard	Cardboard is essentially made from cellulose fibre along with glue and solvents that are harmful to the environment when burnt.
Plastic	As it is made up of petrochemical products, combustion produces high levels of toxic gases. This is a major source of environmental pollution.



To limit the risk of pollution following a fire, the following measures are recommended.

Fire prevention measures

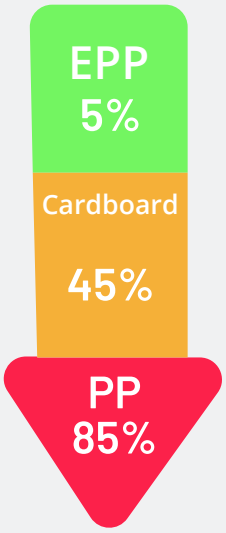
Material	Requirements
Materials studied	Keep information regarding chemical composition and toxic emissions
	Tackle the fire in the correct manner: • Limit the spread of flames • Reduce the flammability rate of the material
	Release only low-density, low toxicity and low corrosivity gases

Human impact of a fire

The combustion of materials leads to a depletion of oxygen.
The normal oxygen content of air is 21% and the minimum safe breathing level is 17%. The higher the CO_2 content in the air, the greater the risk of immediate death. According with guidelines set out by occupational health and safety bodies, in the event of low oxygen levels and the presence of smoke on company premises, management is obliged to evacuate employees in accordance with a pre-established process.

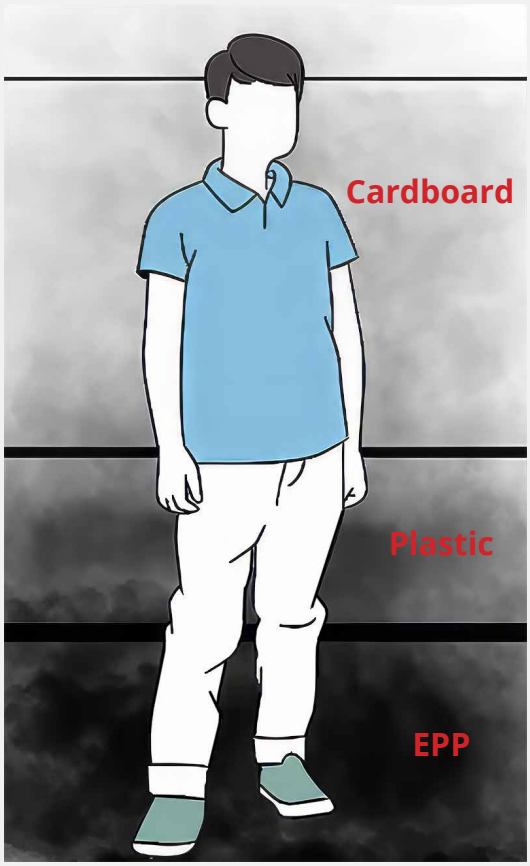
Physiological reactions caused by carbon monoxide	
CO content in the atmosphere (%)	**Reaction**
0.01	Headaches
0,06	Dizziness
0,1	Fainting
0,2	Coma, rapid death
0,5	Immediate death

Percentage of CO in combustion fumes
Percentage per m^3 of material



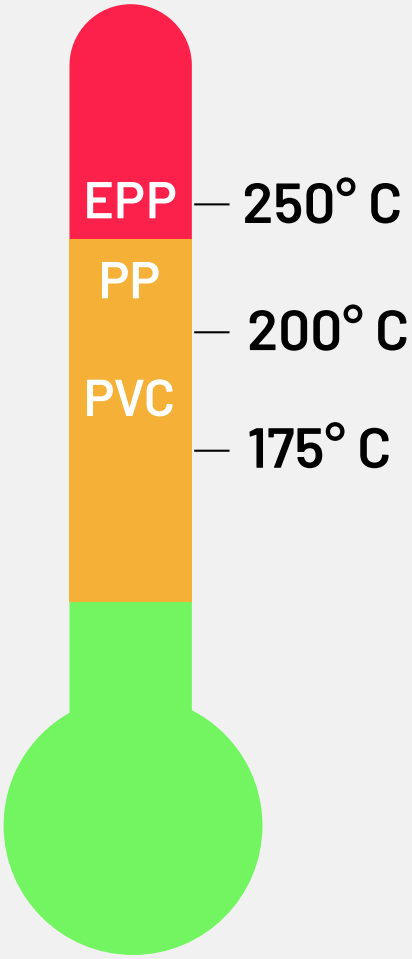
Symptoms caused by a decrease in atmospheric oxygen concentration	
Oxygen content in to the atmosphere (%)	**Effect on humans**
17	Increased heart rate
16	Dizziness
15	Episodes of apnoea / Loss of motor control
12	Loss of consciousness / Irreversible brain damage
10	Inability to move / Nausea
6	Convulsive movements / Death in 5 to 8 minutes

Diagram of the propagation and density of combustion fumes



Cardboard: light grey smoke
Plastic: dense black smoke
EPP: very dense black smoke

Diagram of temperatures at which toxic emissions occur



03. POLLUTION OF THE NATURAL ENVIRONMENT

Fire-fighting water

For certain facilities, there are environmental protection obligations in relation to fire-fighting water. The exact obligations will depend on the nature and quantity of the hazardous substances stored within the facility. If fire-fighting water is not retained, there is a risk of pollution from run-off of contaminated water.

Important Info!
500 tonnes of plastic is equivalent to 500,000 EPP trays!

Cases subject to fire-fighting water retention obligations
Companies subject to regulations concerning accidents leading to pollution of the natural environment
Companies without a technical fire protection system
Building materials with a high thermal load
Storage warehouse > 500 tonnes of plastics

Environmental impact

Packaging discarded “in the wild” can have an impact on aquatic and land environments.

Aquatic environment		
Material	Water pollution	Aquatic life hazards
EPP	Dangerous	Very dangerous
Plastics	Very dangerous	Very dangerous
Cardboard	Not harmful	Not harmful

Land environment		
Material	Degradation of subsoils	Risk to fauna and flora
EPP	Dangerous	Dangerous
Plastics	Very dangerous	Very dangerous
Cardboard	Not harmful	Not harmful

Very dangerous
Dangerous
Not very harmful
Not harmful

04. MICROPARTICLES AND MICROPLASTICS

Cardboard

Illness / Accident	Consequences
Cardboard dust allergy	Skin irritation and itching. Breathing difficulties. Chronic respiratory problems
Asthma	Symptoms aggravated by exposure to cardboard dust.
Accidental fall	A high level of cardboard particles creates a layer of dust on the floor, making it slippery (wet or dry).
Fire hazard	A high concentration of cardboard dust in the atmosphere can cause an instant explosion.

Plastic Tray / EPP Tray

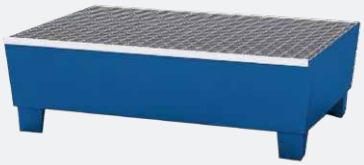
Plastic trays do not immediately pose environmental risks. However, when they are broken or subjected to stress (shocks, deformation, etc.), they can release microplastics. The exact risk to the environment of these microplastics is yet to be confirmed, but it is believed to be significant. The amount of microplastics generated by plastic packaging varies according to different criteria:

- Exposure to UV rays and inclement weather
- How it sheds
- The additives and colourings it contains
- Whether the material contains fibres

Microplastics	
Definition	The term «microplastic» refers to plastic particles smaller than 5 mm.
Environmental Consequences	Worn plastic packaging that is disposed of in the natural environment generates microplastics that do not degrade easily.
Consequences for humans	Our bodies ingest between 52,000 and 121,000 microplastic particles per year, equivalent to 5g per week (20kg over a lifetime), of which 99% are naturally rejected by the body but 1% remain permanently.

05. SAFETY EQUIPMENT

There are no specific regulations on safety equipment for packaging made of cardboard, plastic or EPP. The European Union (REACH Regulation) contemplates a regulation on the classification, labelling and packaging of hazardous chemical products.

Safety equipment	Visuals
Retention bins adapted to each product category.	
Absorbent material: protective equipment for the safe recovery of any accidental chemical spillage.	
Sprinkler: Fixed fire extinguishing system with an automatic water pump.	

06. SUMMARY

	Fires			Microparticles
Material	Production of toxic gas (proportional)	Environmental Consequences	Consequences for humans	Consequences for humans
Cardboard	Dangerous	Not harmful	Dangerous	Not very harmful
EPP	Not very harmful	Not very harmful	Dangerous	Dangerous
Plastic	Very dangerous	Dangerous	Very dangerous	Dangerous

Very dangerous · Dangerous · Not very harmful · Not harmful

COMPARATIVE

STUDY

THE FUTURE OF MATERIALS

03

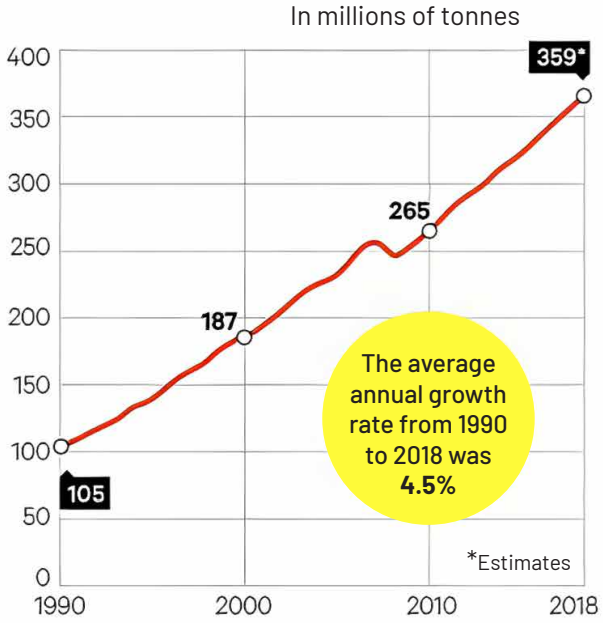
CONTENTS

01. MATERIAL

Plastic / EPP

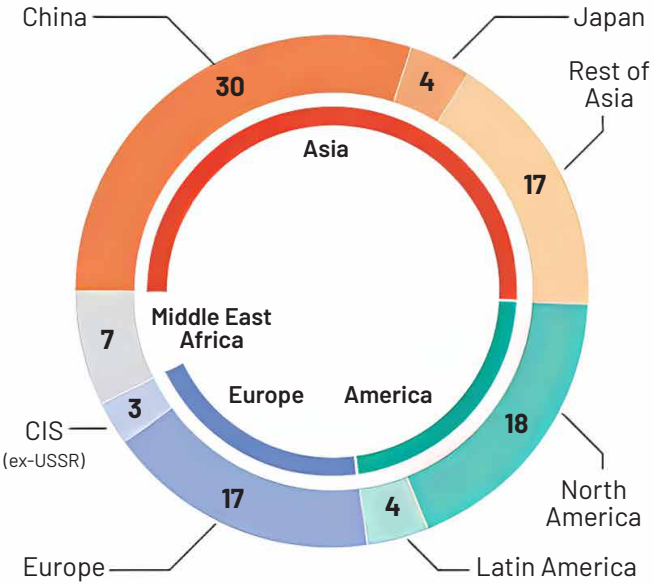
Global plastic production has tripled over the last 25 years, and this growth is unlikely to slow down. The planet consumes 3x as much plastic as it did 25 years ago. Despite plastics being heavily criticised in shock media articles, plastic consumption has showed no signs of abating; in fact, it has increased every year by 4.5% since 1990.

Global plastic production on the rise



Asia, the main producer

As a % of total production in 2018



Sourcing

There are currently major supply problems for plastics, and this has led to substantial price increases, with the price of PP rising by around €140 per tonne. These price rises are likely to continue for several years.

Plastics are part of a geopolitical context, with various countries competing for market share, leading to a "raw material war". In 2021, China launched its 14th five-year plan to increase plastics production capacity and become self-sufficient. However, it is still a long way from achieving this objective, as large volumes of material are imported by other producer countries.

There is a great deal of international trade, from the USA to Europe. The fall in Chinese demand, combined with its new production capacity, has allowed an increase of US imports to Europe. European prices have risen sharply as a result of several production stoppages, and as a result, the United States has begun exporting to Europe once again, offering much more competitive prices than European producers.

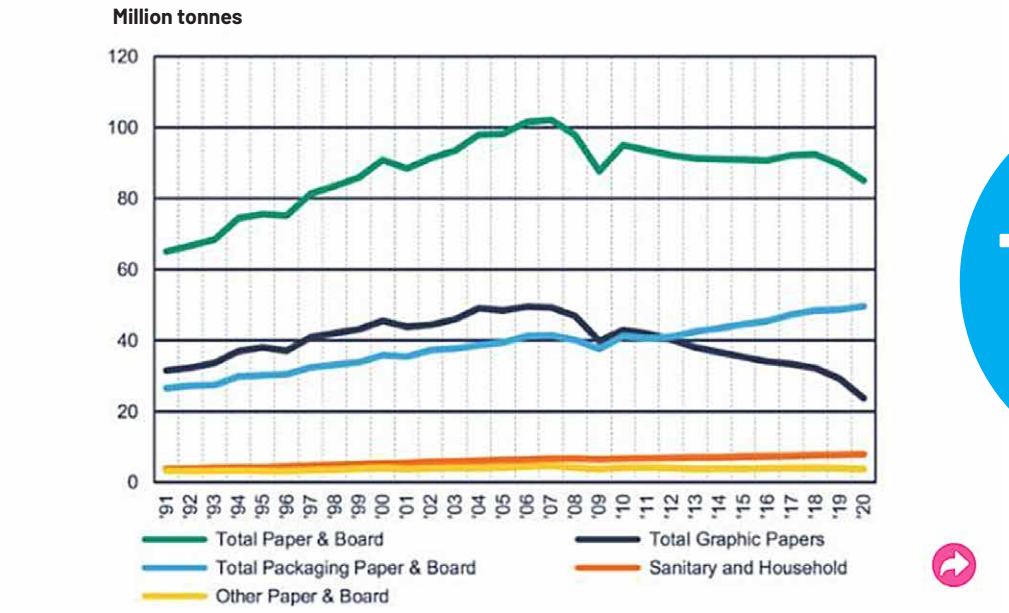
Carton

Production

Paper production in CEPI* member countries fell by 5% in 2020, mainly due to the Covid-19 pandemic. Meanwhile, cardboard sales rose slightly. Demand for cardboard packaging continued to grow in 2020, due to the sharp increase in e-commerce during the pandemic. DS Smith, in particular, has seen business grow by 17% thanks to e-commerce.

Packaging production has risen by 2.1% compared with 2019 and corrugated cardboard box production has increased by 3.3%. Consumption is also on the rise every year, growing by 14% in 10 years.

Paper and board production by Cepi member countries from 1991 to 2020



+2,1%
Increase compared to 2019

Sourcing

Since 2020, the cardboard market has been hit with overwhelming demand that is outstripping the offer. Since the pandemic, there has been a sharp rise in e-commerce, which, in turn, requires more cardboard packaging. However, increased demand for construction timber has led to a shortage of wood pulp, the raw material used to produce paper for cardboard sheets and boxes, thus further limiting supply. This has led to increased delivery times.
As a result of all this, prices have risen, and these have been further compounded by factory closures around the world. The Arjowiggins Group, for example, has stopped the production of certain recycled cardboards in France. This encourages local printers to source their materials abroad, which has a detrimental impact on French industry. This upheaval is also having an impact on subcontractors, who are seeing their biggest customers look elsewhere.

Plastics / EPP

Regulations / Recommendations

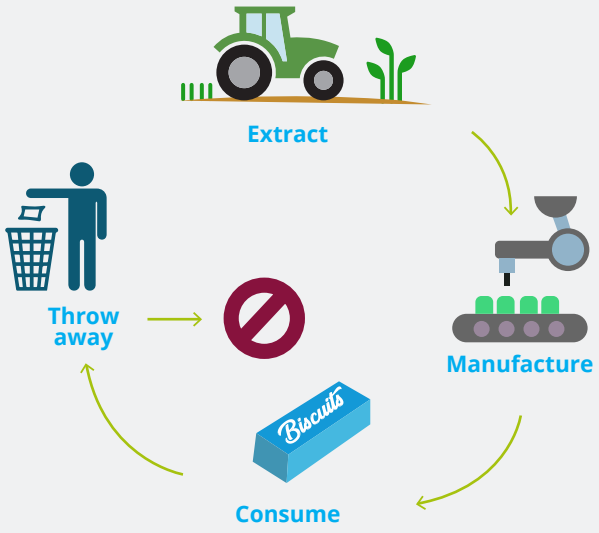
- **Plastics are subject to a wide range of regulations**, and in the future, Europe will have to tighten these environmental restrictions in order to reduce their impact on the planet. It is important to prepare for these changes now.
- **The European Climate Law is determined to turn promises into legal obligations**. The European Union has taken steps to achieve the goal of a carbon-neutral Europe by 2050 and to reduce emissions by at least 55% by 2030. All EU countries will be required to achieve greenhouse gas neutrality, mainly by reducing emissions, investing in green technologies, and protecting the natural environment.
- **The aim is also to use recycled materials in the manufacture of new products**. Countries in the European Union have introduced a tax on virgin plastic packaging to encourage plastics manufacturers to use more recycled plastics.
- **The government is supporting the plastics recycling industry** by allocating €16 million as part of a stimulus package.
- **Draft Decree of 1 January 2022**. Sites handling industrial plastic granules are required to have equipment and procedures in place to prevent granules leaking into the environment.

The aim of the European action plan is to provide a forward-looking programme to create a cleaner, more competitive Europe. The goal is to move from a linear society (extract, manufacture, consume, throw away) to a circular economy.

This requires progress in the following areas:

- Sustainable sourcing
- Eco-design
- Industrial and territorial ecology
- The functionality economy
- Responsible consumption

- Extending the period of use
- Improving waste prevention management and recycling



Linear model
(Everything disposable)

Circular model (Reuse)

Labels and certifications

Labels and certifications exist to facilitate and ensure recognition of product characteristics relating to production and recyclability. They are a mark of credibility that helps to promote products, services, and companies.

The MORE label is awarded to manufacturers who use a certain percentage of recycled plastics in their production. It is awarded each year on the basis of declared volumes of recycled raw materials consumed. In May 2019, EuPC launched a digital tool that allows manufacturers to enhance their CSR policy and promote innovations linked to the circular economy.

EuCertPlast certification gives suppliers and customers the assurance that post-consumer plastics are processed according to best practice and with respect for the environment. The certification regulates processes and aims to improve traceability and the percentage of plastics being recycled in Europe by prioritising quality management, environmentally friendly recycling and process standardisation.

The Centre Technique Industriel de la Plasturgie et des Composites (IPC) and LNE have joined forces to create a certification scheme for industrial users of recycled plastics. This certification will cover overall volumes of recycled plastic used throughout the factory and the specific quantities contained in a product.

Cardboard

Regulations / Guidelines

There are no specific regulations governing the use of cardboard and there are no restrictions on its environmental impact. As cardboard is essentially made from cellulose, it is not perceived as being harmful to the environment when compared with polymers.

Labels and certifications

However, there are a number of labels and certifications to ensure and facilitate recognition of certain product characteristics, recyclability, management of resources used and the environment. These are also marks of credibility that help to promote products, services and companies.

Pulp production labels	
ECF CARING FOR NATURE	Certifies that the pulp has been bleached using a process free from elemental or gaseous chlorine.
ECF CARING FOR NATURE	Certifies that the pulp has been bleached without the use of chlorine.
TEF	Combines pulp and paper production processes without any aqueous discharge into the environment.

FSC	Identifies products from responsibly managed forests.
PEFC	Provides assurance that the paper used is made from pulp produced from sustainably managed forests.
EMAS	System enabling organisations or companies to make voluntary commitments to improve their environmental performance. Issued by the EU.
	A certification system designed to help European consumers identify the most environmentally friendly products and services.
BLAUER ENGEL DAS UMWELTZEICHEN	Awarded to paper produced from recycled fibres, the manufacture and composition of which are highly regulated.

2. ENERGY

Plastics / EPP

Manufacture

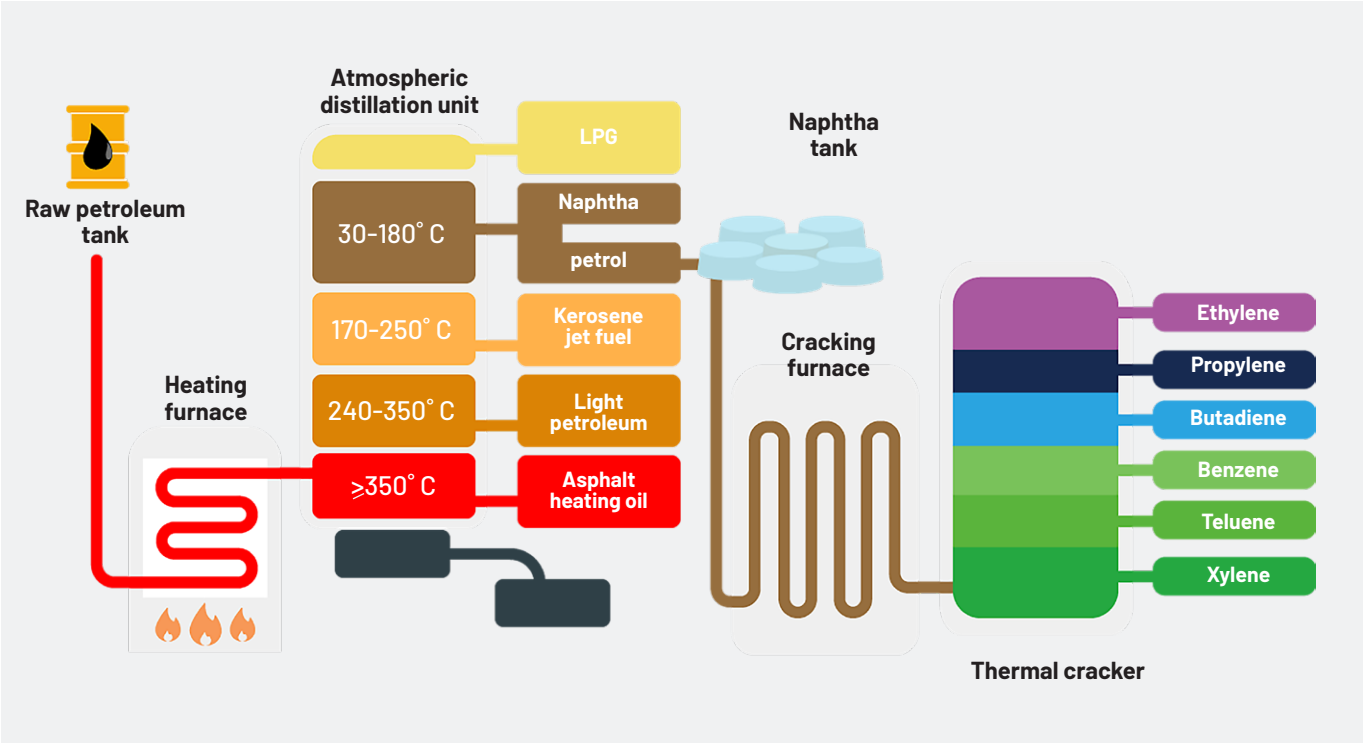
Plastics are essentially made from petroleum, which is combined with gases and a tiny percentage of water to obtain the final resin.

Oil is first extracted using water or gas injection systems. The oil is then refined by heating it to several hundred degrees to separate its thousands of constituents, which requires significant amounts of energy.

Then we move on to the cracking stage, where the petroleum liquid and steam are combined and heated to 800°C, then to 400°C.

The resin is pelletised for delivery to a transformer, where it is heated and melted for injection moulding or extrusion. Large amounts of energy are required throughout the manufacturing cycle.

Plastics manufacturing

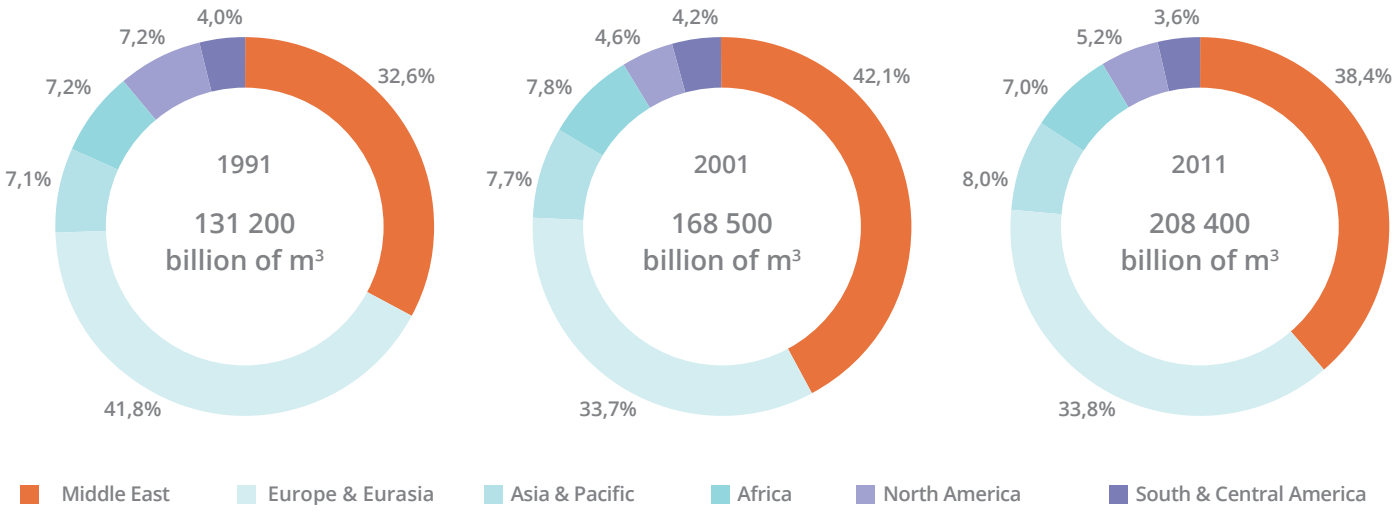


The EPP is made up of 6% material and 94% air. As a result, it requires fewer resources and less energy than standard plastic.

Manufacturing 1 kg of plastic requires between 1L and 2L of water, depending on the type of plastic being made.

Use of 'new' resources:
In the future, natural gas will be the second most widely used energy source. Reserves appear to be abundant and, with new technology, increasing sources of natural gas are being discovered.

Breakdown of natural gas reserves worldwide in 1991, 2001 and 2011



Cardboard

Manufacture

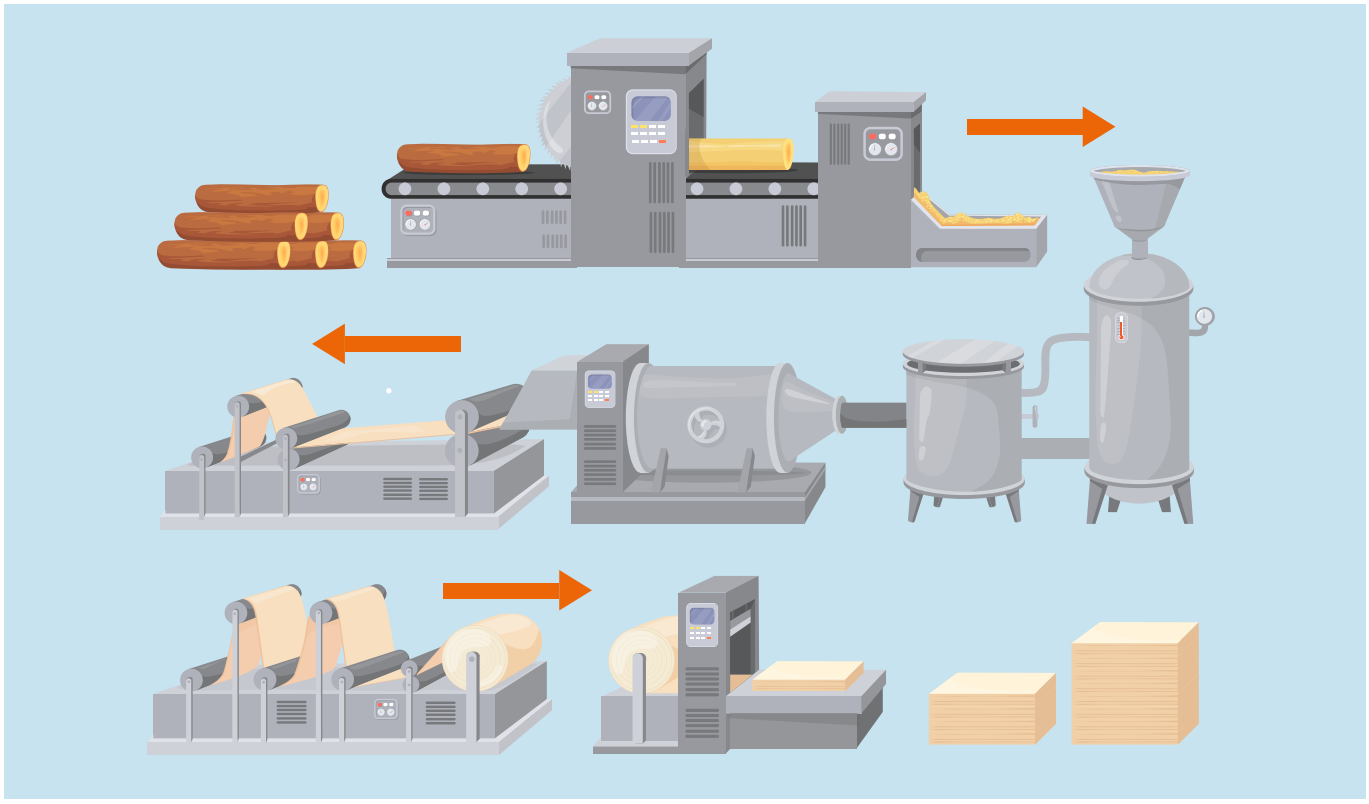
Cardboard is essentially composed of cellulose, and the pulp generally contains 40% wood pulp and 60% recycled paper and cardboard. Then, additives and colourings are added to enhance the characteristics of the cardboard.

The problem with these additives is that when they are added to the material, they pollute the air and can release gasses that are harmful to the health of operators. Furthermore, these additives pollute production water, which is then discharged and treated, which requires additional energy. Cardboard packaging discarded in the natural environment pollutes nature because of the additives it contains.

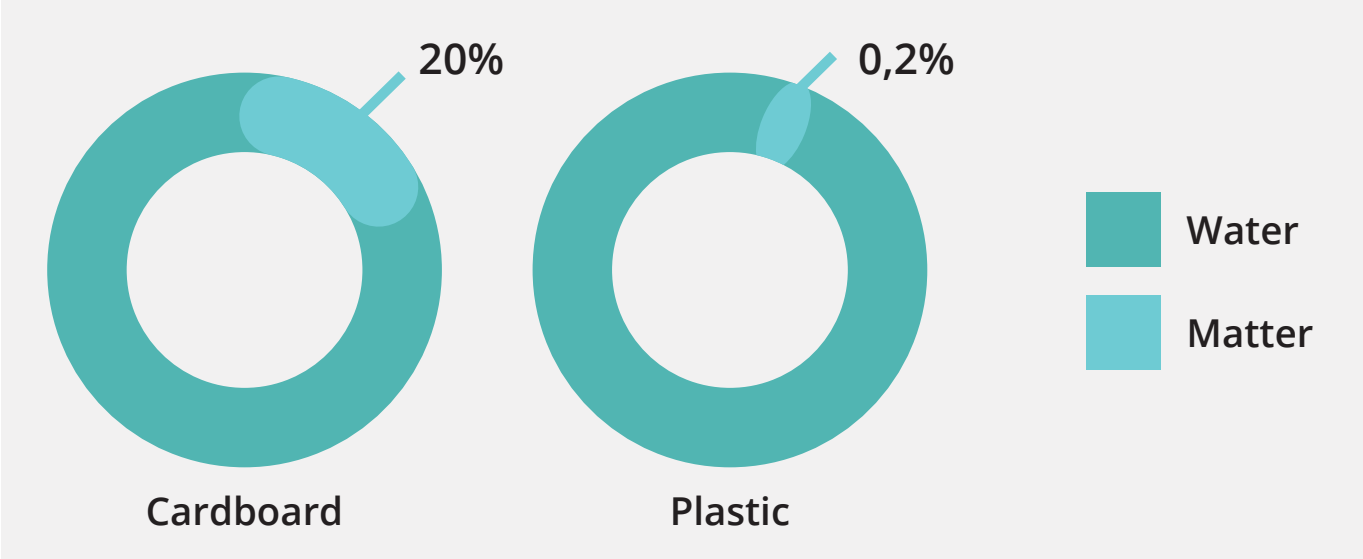
Paper pulp composition

The wood used to make cardboard in France is managed responsibly and governed by regulations. But in other countries, such as Canada, Russia and Asia, wood is managed in the wild, which, according to WWF, is leading to increased deforestation of 13 million hectares every year.

Manufacture of corrugated cardboard



Cardboard / Plastic: Water consumption per 1kg of virgin material produced



03. RECYCLABLITY

Plastics

In France, between **1.9 and 4.5 million tonnes of plastic waste are thrown away every year**. Yet the recycling rate for plastic waste in France is only 26%, with 43% going to energy recovery and 32% ending up in landfill.

Once plastics have been discarded, sorted and baled, they are regenerated. The flattened plastics contained in the bales are cleaned, shredded and softened, and the plastic packaging becomes flakes of different colours.

These flakes are then washed and heated at very high temperatures to transform them into plastic granules. The pellets are then sent to recycling plants for a new lease of life.

However, plastic is not infinitely recyclable. On average, it can be recycled up to 3 or 4 times. At this point, it can then be converted into energy in a waste incinerator.

Plastic is much more environmentally friendly when recycled because it requires much less energy to recycle than to produce. During production, there are a multitude of processing stages that consume huge amounts of energy, whereas for recycling, it only needs to be heated in order to melt it (see diagram on next page).

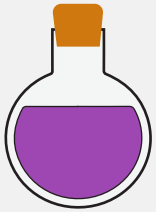
Carton

RECYCLAGE

Cardboard goes through a sorting line where different materials are separated by type and compacted into bales before being sent to specialist plants for processing.

At the cardboard recycling plant, the sorted material is mixed with water and then "pulped and de-inked". The result is a paper pulp that is drained and dried, then wound into reels. These will then be transformed into new cardboard boxes.

However, during this recycling cycle, the cellulose fibres become damaged. This means that they can only be recycled around 5 times. After that, they can be turned into energy in a waste incinerator.



Development of a new chemical recycling technology to increase the rate of re-use of plastic raw materials.

Cardboard is not necessarily more advantageous when it comes to recycling, because it requires a lot of water and energy for treatment and manufacturing. The benefit of producing virgin pulp is that the trees used have captured carbon from the air, thereby improving air quality.

EPP

Recovery of small amounts of material due to its composition (94% air for 6% recoverable material).

Collected, ground and incorporated into the production of other expanded polypropylene products.

Once it has been used up, it is used as fuel to generate electricity.

Collecting EPP is difficult as it is a brittle, volatile and bulky material, making it difficult to transport. Presses are set up near plants to compact the material before it is transported.

Plastic

1 tonne of recycled plastic saves the equivalent of a year's energy consumption for 2 people and 2 months' water consumption for one person.

2 kg of raw petroleum

=

1 kg of PP

Oil is a non-renewable resource. 6% of the oil used worldwide is used to make plastic (3% of which is used in packaging), and this figure is set to rise to 20% by 2050.
To increase the recycling rate, companies in the plastics industry have agreed on the need to set up an exchange network and develop contacts with the various players in the plastics recycling sector. It is hoped that this will help to promote innovation and establish subsectors through collaborative projects to mobilise all available expertise in the sector.

Cardboard

Recycling one tonne of cardboard avoids the "consumption" of 2.5 tonnes of wood, 50 m^3 of water and 10,000 kWh of energy

=

A light bulb turned on for **70,000 hours**

	Energy consumption		Pollution emitted	
Results per tonne collected	Virgin pulp (kWh)	Recycled pulp (kWh)	Virgin pulp (kg Eq CO_2)	Recycled pulp (kg Eq CO_2)
Cardboard	13115	3017	390	670

This table from an ADEME study shows that emission factors from recycled materials are higher than those from virgin materials. According to FEFCO, the virgin cardboard industry uses more energy on average in Europe.

Important Info! General information about waste traceability.
Only part of the plastic packaging waste stream is properly monitored: the Extended Producer Responsibility (EPR) stream for household packaging, unlike the catering and Industrial and Commercial Packaging (ICP) streams.
In France, the Decree on the 5 streams of waste makes it obligatory to sort waste at the source. As a result, companies are obliged to collect paper/cardboard, metal, plastic, glass, and wood separately for any volume in excess of 1,100 litres/week.

04. TRANSPORT / LOGISTICS

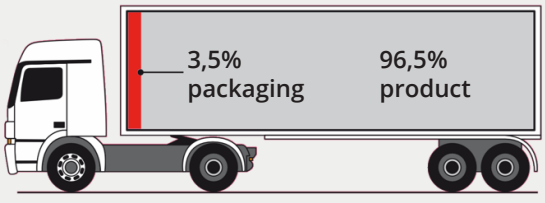
Logistics / Transport

The e-commerce industry is experiencing strong growth, leading to increased consumption of corrugated cardboard (particularly around Christmas, Easter or Valentine's Day, for example). However, a significant volume of boxes used is empty (64% on average). Is it time that we looked for an alternative to single-use cardboard for e-commerce logistics?

Some e-logistics companies are using a new technology: making custom, personalised boxes instantly by scanning the product dimensions.

If plastic packaging were completely replaced by other materials such as cardboard, glass, metal or wood, the weight of packaging would be multiplied by 4, energy consumption by 1.5 and production costs by 2.

Glass



Plastic

This reduces :

- **The number of lorries** by optimising flows
- **Empty runs**, thus increasing capacity

Digital technology can also be a solution for pooling resources and improving transport efficiency. The rise of digital technology in the road haulage sector should provide a whole range of solutions for optimising transport and improving equipment operating conditions:

- **Pooling transport demand and supply** via large platforms will reduce empty mileage.
- **Real-time supply chain connectivity and artificial intelligence** will make it possible to adapt the reallocation of stops (loading or unloading), whatever the circumstances, which will improve capacity utilisation.
- **Continuous geolocation monitoring** will reduce inefficiency losses (underloading, over-consumption of energy, etc.) and increase safety for people and goods.

The French national logistics strategy: The aim of France Logistique 2025 is to define the national logistics strategy in order to become a world leader. In particular, it covers the following points:

- **Ensuring better traceability of flows using IT systems** applied to the different connected modes of transport.
- **Using multimodal transport** for businesses to promote internationalisation of trade, sustainable development and cost optimisation.
- **Simplifying regulations for logistics activities**, which are currently subject to administrative, customs, tax, social, property and environmental regulations. As a result, the challenge for logistics is to identify priority measures that could help make administrative tasks smoother and more agile for companies in the sector, for example, by digitising certain documents.
- **Establishing a circular economy**: Efficient reverse logistics not only improves competitiveness for businesses but are also essential to the creation of a circular economy. Reverse logistics is part of an increasingly open and shared logistics system.

There is a programme to help companies reduce the energy consumption and environmental impact associated with their transport and logistics activities. The Voluntary Environmental Commitment programme (EVE, in French initials) aims to:

- Reduce greenhouse gases (GHGs)
- Limit atmospheric pollutants

The following operators in the road transport and supply chain sectors also have a role to play:

- Loaders
- Freight forwarders
- Freight carriers
- Wholesalers
- Passenger carriers

They are committed to improving the environment and, through their voluntary actions, help to improve air quality every day. The programme also awards an EVE label to companies applying the various measures.

ENGAGEMENTS VOLONTAIRES POUR L'ENVIRONNEMENT
transport et logistique

05. THE FUTURE

Cardboard

In the future, cardboard will play a major role in the circular economy, particularly as e-commerce continues to grow. Cardboard use is increasing and will continue to do so in the years ahead.

Cardboard is seen as an up-and-coming alternative because, in the eyes of consumers, is a natural and harmless material.

Furthermore, the Centre Technique du Papier (Technical Paper Centre), a leading international research organisation in the paper and cardboard industry, is investing in R&D on cardboard to offer a recyclable and biodegradable alternative to certain plastics and paperboard.

Its objectives are:

- Lighter paper and cardboard packaging to save raw materials and transport costs.
- The study and development of sustainable solutions.

The discovery of a potentially revolutionary technology, chromogenics, is also likely to lead to new developments in paperboard. By grafting a fatty acid molecule onto the material, it is possible to make it hydrophobic and water-resistant without adding other materials.

This technology also means that the mechanical properties, aesthetics and feel of the paper are all preserved.

In the future, cardboard will need to:

- Guarantee and improve the recyclability and biodegradability of packaging.
- Include improved barrier properties (resistance to water, air, and grease).

Key facts about the future of cardboard:

- Currently, cardboard has poor barrier properties. In the future, new solutions will likely be developed to overcome this problem.
- New technologies and new processes will make cardboard more competitive and adaptable for all sectors and applications.
- Cardboard could therefore become a major competitor to plastic if solutions are found to the current drawbacks.

Plastic / EPP

Current trends indicate that the use of resins in plastic production is projected to increase by an additional 70% between now and 2050. Plastic protects food from the sun, stops it from drying out and protects it from humidity. It is ideal for creating a barrier against external elements to protect products as effectively as possible and is therefore essential in

certain applications.
EPP packaging supports the refrigeration chain thanks to its insulating properties, thereby saving energy. Weighing less than any other packaging material, it is an attractive option for transport as it will reduce fuel consumption. With all its benefits, EPP is a material with a long future ahead.
One challenge in the future will be access to recycled plastic, particularly when it comes to bringing petrochemists and recyclers closer together to create a closed loop for better access to recycled materials.

Currently, France is lagging behind the rest of Europe in terms of recycling packaging, ranking second last. However, the country's recycling rate should reach 75% by 2040 with the development of chemical recycling. This is a process that modifies the chemical structure of plastic waste, converting it into smaller molecules that can be readily used in

new chemical reactions.

06. RECOMMENDATIONS

- **The future of packaging materials is still uncertain**, but it is possible to make some assumptions in order to prepare for the potential changes to come.
- New laws and regulations are being introduced to protect the environment. **It is**

therefore important to take them into account and anticipate future regulations.

- We need to **find alternatives for production processes, recycling, and goods transportation**. These sectors currently release significant emissions and consume a huge number of resources.
- For the production of raw materials, **the installation of equipment to reduceenergy consumption** may become standard in factories, such as heat recovery systems, closed circuits, and solar panels.

The arrival of artificial intelligence and other new technologies will almost help develop future processes, helping to optimise production and supply chains. This means that it would be wise to take a serious interest in these technologies in order to keep up with the industry of the future.

Recycling facilities for all materials are not yet well-developed. It is crucial to further develop these channels if we want to achieve a higher recycling rate. By recycling more materials, we can reduce the production of virgin materials and save resources that are often non- renewable.

New sources of energy, new material components and new technologies may emerge, all of which could lead to changes in characteristics such as material strength, recyclability, ergonomics, weight and even energy consumption.

Many changes are also likely to occur in logistics transport, but solutions already exist, as we can see in this white paper. Therefore, it is important to rethink how we do logistics transport now so as not to be caught out by potential new regulations when they emerge.

07. SUMMARY

	Material	Manufacturing (energy)	Recycling	Shipping logistics
Cardboard	✓	≈	✗	≈
EPP	✗	≈	≈	✓✓
Plastic	✗	✗	≈	≈

✗ Not optimised ≈ Slightly optimised ✓ Currently being optimised ✓✓ Non-hazardous

THE KNAUF

INDUSTRIES SOLUTION

04

01. CHOOSE LIGHT HANDLING WITH KOMEBAC®

These days, companies have more societal obligations, and this often means that they must review their processes and products in order to meet expectations.
When it comes to logistics, transport, and storage, it's all about "light handling". Besides the environmental benefits, our products also help save time for operators and improve ergonomics at every stage of the supply chain, from production to storage and dispatch.

A lightweight, reusable plastic tray...

The Komebac® range offers practical solutions for light handling and transporting goods in a wide variety of sectors (such as automotive, electronics, cosmetics, and pharmaceuticals).
This lightweight tray (weighing a maximum of 2 kg) can support loads of up to 1,000 times its own weight (depending on the model). Ergonomic and easy to handle, it offers maximum convenience while eliminating noise when moving on conveyors. It is also isothermal, washable, and suitable for contact with food products.
Finally, it's a practical response to the problems associated with musculoskeletal disorders. These lightweight trays protect pickers, handlers and delivery personnel as the loads carried on a daily basis are lighter.

...that's also environmentally responsible.

Komebac® is made from expanded polypropylene (EPP), a mono-material that can be easily recycled at the end of its life and use for new production (up to 100% of recycled material).
Compared with an injected polypropylene tray of similar dimensions, it is 62% lighter and cuts CO_2 emissions by 45%. It has a lifespan of more than 10 years, and one Komebac® tray will save the use of 1,000 cardboard boxes over this period.
It also bears the Solar Impulse label, awarded by the foundation presided over by Bertrand Piccard for being a "high-performance solution for the environment". Choosing Komebac® makes perfect sense at a time when the reuse and recovery of packaging is so essential.

KOMEBAC® ORIGAMI: the foldable tray, the solution for the future?

Knauf Industries has decided to take our R&D one step further by offering foldable solutions, the future of reverse logistics. Brainstorming and project meetings led our team to develop Komebac® Origami, a mini box that demonstrates the different hinge options available for a folding solution.
As a single unit, it can be folded on itself without dismantling to save space in storage and when returning empty. The lid is recessed to prevent it folding in on itself when assembled. This solution is not yet a standard product, but the aim is to showcase our expertise and work with customers to explore the possibilities of developing it further in line with their needs and requirements. Imagine the box of the future. A lightweight yet sturdy box that can be reused, folded, and fully recycled at the end of its life.

02. FROM STANDARD PRODUCTS TO CUSTOM-MADE, IT'S JUST ONE STEP
YOUR NEEDS, OUR EXPERTISE, THE RIGHT SOLUTION!

Custom-made solutions tend to scare some people. They take longer to implement, cost more, are less readily available and have longer lead times. But did you know that custom-made solutions have become increasingly popular in recent years, and that they can be used for many different initiatives, such as effective marketing and inclusive management? Furthermore, when it comes to packaging, custom-made solutions can be designed to fit the product perfectly, thereby reducing the amount of “empty air” transported.

What is a custom-made solution?

A custom-made or tailor-made service or product has been developed for a specific product or function according to the customer’s specifications.
Tailor-made products can be found in all industries and are used for a wide variety of products. Let’s take a few examples. In the car industry, from all the options available, there are hardly any identical top-of-the-range models. Mini, for example, has made this one of its selling points.

Calbag offers a fully customisable suitcase, with different colour options, accessories and even the possibility of choosing an image. Evian offers personalised engraved glass bottles.

3D printing is also expected to play a role when it comes to customisation and small production runs.

We offer two types of potential customisation based on our Komebac® range:

- **Customisation** of a standard product.
- **Development of a 100% bespoke product** tailored to your needs.

Customisation, from custom-made to semi-standard

The standard Komebac® tray is black and features the standard Komebac® branding. However, when the range was launched, customisation had already been taken into consideration so that we could give our customers the opportunity to stand out from the crowd.

What can be customised?

- **Branding**: you can customise the tray with your logo (4 per Komebac®) or add doming (also known as a domed label or 3D label).
- **Colour**: visual management helps operators to follow correct procedure more easily. This can include colour-coding parts to be installed, location of parts when not in use, etc.
- **9 colours available**: pink, orange, yellow, green, black, blue, grey, white, OCEAN (made from 15% waste from the shipping industry).
- **Interior fittings**: to pack the parts. Specific fittings moulded as one piece or made-to-measure removable foam.
- **Integration of sensors**: option of integrating a slot for wireless technologies (RFID or NFC).

Development of a 100% bespoke product

Depending on your requirements, a 100% custom-made solution may be more suitable. Of course, you will need to invest in tooling, but the investment will be worth it if the product meets all your requirements and helps increase productivity and competitiveness (saving time, storage, transport costs, etc.).

In this case, we can develop the following:

- **Structure**: adapt the trays so that they can be stacked, nested, used as pallet trays, with castors, etc.
- **Handles**: centred handles, open/through handles, etc. [standard handles are non-open and staggered].
- **The lid**: an attached lid.
- **Dimensions**: according to your needs and constraints.
- **Material**: if you need ESD material in particular.

The key role of the design office

It is important for the design office to be involved from the outset to develop the most appropriate solution for your constraints.

Our design office will work on your customised solution and support you throughout each phase of the project, from design to manufacture and quality control. You'll have a dedicated contact person to talk to throughout.

03. CUSTOMERS WHO TRUST US

1. BOEHRINGER INGELHEIM: VALUE THROUGH INNOVATION

The Boehringer Ingelheim laboratory no longer uses metal or plastic injection handling containers.

The decision has been made. They are now using a better solution for four main reasons... read on to find out more!

The world's first independent laboratory

Boehringer Ingelheim develops innovative therapies that have the potential to change the lives of patients and animals, with a comprehensive «One Health» approach.

In human health, Boehringer Ingelheim offers a range of treatments in five main therapeutic areas: pulmonology, cardiology, oncology, diabetology and neurology.

In animal health, Boehringer Ingelheim develops innovative solutions in the field of vaccines, antiparasitics, therapies and related services for domestic and farm animals.

Ensuring the health and safety of patients and animals is the company's main mission, and for Boehringer Ingelheim, taking care of its employees is just as important.

At its Toulouse site, the company recently decided to replace its handling bins, which were initially made of metal or injection-moulded plastic.

The magic of lightweight plastic containers in expanded polypropylene

It was the discovery of the Komebac® range that triggered this change. After being tested in real-life conditions, the Komebac® tray was adopted for a number of reasons:

- **The lightness of the trays** means that they are easy to handle and help protect operators from musculoskeletal disorders.
- **Customised colours**: for visual management and to simplify procedures (separate colour assigned to each procedure).
- **Protection of equipment**: the material does not damage machines when it is accidentally banged against them.
- **The flexibility of the material**: this makes it easy to change the height or add handles.

The choice of Komebac® also allowed us to standardise the trays and improve their ergonomics, while opting for an eco-responsible solution. The trays are made with expanded polypropylene, a reusable and 100% recyclable material.

What does the company plan to do next? A watertight intermediate storage project with light, reusable handling.

2. WHEN FRENCH TECHNOLOGY AND EXPERTISE ARE MADE TO WORK FOR PEOPLE

Awabot has decided to switch to reusable packaging for the robots its produces.
Which product have they chosen? What packaging? What is the change? Which materials?

We caught up with Hugues Trochu to find out more about AWABOT, a pioneer in inclusive telepresence (a set of techniques allowing people to have the impression of being present in a place other than their physical location) in France.

This company focuses on three areas:

- **Responding to social and societal issues**, such as inclusion and maintaining connections for people with disabilities (educational continuity, distance learning, teleworking, distance management, etc.).
- **Reducing the carbon footprint** of business travel.
- **Progress** through robotics that puts people before technology.

BEAM® is one of the solutions they offer, a leading remote presence solution.

BEAM® becomes your avatar. Once connected to the device from a computer, you can interact with your contacts and move freely within the remote environment, as if you were there.

Until 2010, the company distributed BEAM® telepresence robots designed in the United States. In January 2021, Awabot decided to relocate and produce them in France at its new premises in Vénissieux, near Lyon.

Concerned about its environmental footprint, the company wanted to review its packaging, and we are proud to have been able to collaborate on this project and to have done away with disposable packaging.

We asked a few questions to find out about the changes brought about by this project

Bulle d'air®: What packaging did Awabot use until now?
Hugues Trochu: We used two types of packaging. The first was a flight case and foam padding, and the second was a disposable cardboard box with foam protection.

BA: Why did you decide to redesign the packaging?
HT: For a more qualitative brand image (especially compared to the cardboard solution) and for its reusability, lightness and potential for reducing waste.

BA: What are the advantages of your new solution compared to the old one?
HT: This new packaging offers a number of advantages:

- It is lightweight, making it easy to handle. It limits the load carried by operators and thus combats RSI. This simplifies storage on the racks.
- The design with integrated wedges makes it easy to position accessories and the robot. Quality control is also optimised (no missed parts).

- The high-quality finish enhances the brand's image, which is very important to maintain its reputation as a leader in the sector. Feedback has been much more positive than with the old cardboard packaging.
- It is reusable, which is very important to us. Awabot generates very little waste from its robots and is very careful about its carbon footprint. This solution serves two purposes: as a storage case for customers when the BEAM® is not in use, and as protection if product maintenance is required.

BA: How much weight is saved by switching to a 100% EPP solution?
HT: Compared with the cardboard solution, the weight savings are around 34% (i.e., 2.6 kg saving per robot) and up to 80% when compared with the flight case solution.

BA: What do you consider to be the most important feature?
HT: Lightweight for easy handling. On the production side, staff are more than satisfied, saying it's «easier» and «saves time».
That's really the first feature I'd highlight, followed by the reusability, which is totally in line with our environmental values.

BA: What improvements do you have in mind for the future?
HT: To relocate production within 100 km of the plant and increase the proportion of recycled material in our packaging solutions.

An award-winning project at Pack The Future 2023

Pack The Future is a competition that rewards innovative and sustainable plastic packaging solutions and aims to promote and raise awareness of the contribution of plastic packaging to climate protection, the circular economy and responsible consumption.

With all the advantages offered by our EPP protective packaging (lightness, single-material design with integrated wedges, eco-design, and reusability), we presented it at the 2023 edition of the Interpack Trade Fair in Düsseldorf.

We are proud to have won a trophy for the third year running, especially with this packaging, which we redesigned, created, and manufactured from scratch.

Thank you to our customer Awabot for their confidence in us and for our joint success!

CONCLUSION

05

I. Conclusion

Reusable packaging offers many benefits for businesses and the environment. In particular, it can reduce costs and improve operational efficiency, and can also help to reduce waste and greenhouse gas emissions.
The different types of reusable packaging available offer companies a high degree of flexibility to meet their specific needs when it comes to transporting and storing goods.

That's why, for 40 years, Knauf Industries has been committed to offering lightweight handling solutions that meet the needs of manufacturers in all sectors. As well as being environmentally friendly, our products save time on production lines, as well as in the storage and dispatch. This makes human work more efficient and helps companies to meet their performance targets.

What is light handling?

Light handling is a set of light technical systems and equipment used to pack, transport and store goods weighing several hundred or even several thousand kilos.

Because companies now have more environmental obligations, they must change the way they operate, reviewing certain processes and using new, more environmentally- friendly products.

Reviewing the logistics of its transport and storage chain and integrating equipment that consumes less energy are just some of the ways that companies can achieve a successful energy transition. It is therefore essential to use reusable packaging that is as light as it is resistant to heavy loads, has a low carbon footprint and is recyclable. Like our ISymoov® handling solutions, for example, which combine lightness, flexibility and performance while meeting today's demanding logistics requirements.

The benefits of light handling

At a time when ecology is at the heart of industrial concerns, light handling makes it possible to experiment with new options to limit the environmental impact of transport operations.

Practical benefits

Light handling offers companies a real alternative. It has an impact on both the storage and handling of products, making it possible to simplify and reduce the various stages in the supply chain.

As they are smarter and more ergonomic to use, lightweight reusable solutions provide added value for operators and businesses alike. When you want to ship goods, the choice of packaging is crucial. But how do you make the right choice? How can I protect my goods properly and optimise shipping costs?

The ideal solution should meet the following essential criteria: lightness, reusability, and recyclability. Like our ISymoov® handling and storage solutions.

Environmental benefits

Mass consumption and the associated supply chain require the use of numerous means of transport, resulting in a growing carbon footprint. To meet the environmental objectives set by governments, companies need to reduce their greenhouse gas emissions so as to limit the environmental impact of their operations. Lightweight handling offers advantages on two fronts: the environment and marketing.

If you want to stand out from your competitors, one way is to publicise your new lightweight, durable handling solutions. Our customers are particularly satisfied with our products for packaging and shipping their goods.

Many people turn to us when looking for lightweight, durable reusable solutions made from recycled raw materials. Our loading, unloading and storage solutions meet their needs in every respect. They are part of the virtuous circle of "upcycling", combining lightness and performance while being reusable and recyclable with a limited carbon footprint. From pallets and cleats to handling trays and reusable insulated coolers, we can meet any manufacturer's light handling requirements.

Save money with bespoke solutions

When you think about environmental concerns, you might immediately think about additional costs. Yet a number of «greener» reusable solutions have already demonstrated their financial benefits, and we have studied market issues and responded to the needs of manufacturers by designing smart products.

By using recycled raw materials, we have been able to reduce costs. With the aim of satisfying every customer, we have designed a wide range of transit products, our ISymoov® range. The initial goal was to eliminate superfluous elements such as plastic film, single-use cardboard, shipping plates, plastic wedging, wooden cleats, etc. The idea was therefore to develop modular solutions that are enough on their own to allow our customers to make real savings in the medium term.

Reusable solutions also help to consolidate your relationships with your customers and suppliers. They help to build confidence and encourage a smooth communication that can be invaluable in business.

Lightness is a real asset and can save you money! Ultra-light rotation packaging allows you to minimise the cost of shipping your goods. With a Komebac®, for example, you can save up to 1,000 boxes. It also considerably reduces the weight of a delivery of 33 pallets by 1,456 kg. At the end of the day, the savings you make will allow you to support a new employee in your budget.

A protected workforce

Many operators suffer from Musculoskeletal Disorders (MSDs), injuries that affect muscles, tendons, nerves, ligaments, and joints. They are often caused by the weight of loads handled on a daily basis, repetitive movements, incorrect posture, excessive physical effort, etc.

It is important to note that accidents at work can have repercussions not only on workers' health but also on their professional life, social life, and general quality of life. That's why it is so important to prevent accidents in the workplace and protect workers' health and safety.

As a result, it is important to choose reusable packaging that is strong but also as light as possible to reduce the loads carried and protect pickers, handlers, and delivery personnel.

The new-generation materials used in the design of our reusable solutions, such as EPP, also help prevent accidents. Fingers are no longer crushed between pallets and wooden cleats, and there are no longer any splinters or other mishaps associated with handling transportation packaging.

II. Komebac® labelled reusable packaging

The choice of Komebac® makes perfect sense in today's industry, where the reuse and recovery of packaging are the key to successful, environmentally friendly logistics. Our handling trays have also been officially certified by the Solar Impulse Foundation as cost-effective solutions that help protect the environment.

The Solar Impulse Foundation is dedicated to accelerating the implementation of clean, cost-effective solutions. It helps decision-makers in business and government to adopt the more ambitious energy policies needed to bring these solutions to market. It is a way of building on the success of the first solar-powered round-the-world flight.

Our handling trays have been thoroughly assessed by a group of independent experts according to five criteria covering the three main themes of feasibility, environment, and cost-effectiveness. They are therefore among the 1,000 solutions to have received the label from the foundation chaired by Bertrand Piccard.

Ultra-lightweight, reusable and recyclable, our EPP Komebac® solution represents essential reusable packaging for sustainable, multi-purpose logistics. Already widely used in the automotive industry, it is also perfectly suited to industrial companies in various sectors that want to protect:

- **Their products**: by absorbing shocks during transport and ensuring stacking without any damage.
- **Their employees**: by ensuring their safety, considerably reducing Musculoskeletal Disorders (MSD), eliminating mechanical risks and the noise associated with the clattering of pallets and ordinary handling solutions on the shop floor.
- **The environment and natural resources**: thanks to its manufacture from a single material containing a guaranteed percentage of recycled material, which can be reused and recycled, thereby reducing CO_2 emissions.

If you have a particular requirement, bespoke project, idea or would like a comparative study of your current solution and our available solutions, please, don't hesitate to contact us. Our team will be available to help find the right solution for you.

SOURCES

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PlasticsEurope, VPK GROUP, Lesechos OIEau, BPI France, GemmaLog, CITEO, ConsoGlobe, L'Elementarium, Reporterre, Ministère de la transition écologique, ADEME, Polyvia, Stratégies logistique, Officiel Prévention

GLOSSARY

EPP - Expanded polypropylene
CU – Consumption Unit
HU - Handling Unit
ESD - Electrostatic discharge
FTE - Full-time Equivalent
MSD - Musculoskeletal Disorders

GALIA - Group for the improvement of connections in the automotive industry
COPACEL - French union of cardboard, paper and cellulose industries

ISO (International Standards Organisation) - Production of international standards in various industrial and commercial sectors.
ASTM (American Society for Testing of Materials) - Standards body that writes and produces technical standards for materials, products, systems and services.
NF (Norme Française) - French standard issued by AFNOR.
AFNOR (French Standards Association) - Official organisation in charge of standards in France.

Biotope - Biological environment with homogeneous living conditions.
CO = Carbon monoxide - Colourless, odourless but highly toxic gas.
CO_2 = Carbon dioxide - A colourless, low-toxicity gas. Main natural greenhouse gas.

CEPI Association - European association representing the paper industry.
Multimodal transport - A mode of transport that involves moving goods from one destination to another using at least two different modes of transport in succession.
Biogas - Produced by the fermentation of organic animal or plant matter.
Reverse logistics - Operations linked to the reuse of products and materials.

ANNEXES

01. Regulations and Standards

There are a number of regulations and standards governing returnable packaging aimed at guaranteeing consumer safety, reducing environmental impacts and promoting good practice in reusable packaging. Here are some examples of these regulations and standards:

- **Regulations on materials in contact with foodstuffs**: In the European Union, regulations on materials in contact with foodstuffs (Regulation (EC) No. 1935/2004) lay down safety and hygiene requirements for packaging used in the food sector. These regulations also apply to reusable packaging.
- **The ISO 18600 standard on reusable packaging**: ISO 18600 provides guidelines for the design, manufacture, use and management of reusable packaging. This standard covers different types of reusable packaging, such as bulk containers, pallet boxes and foldable trays.
- **Regulations on packaging waste**: In the European Union, regulations on packaging waste (Directive 94/62/EC) impose obligations on packaging producers for the management of packaging waste, including reusable packaging. These regulations aim to encourage the reduction, reuse, and recycling of packaging waste.
- **Environmental protection regulations**: Many countries have environmental protection regulations aimed at reducing the environmental impact of industrial activities, including the production and use of reusable packaging. These regulations may include requirements for the reduction of greenhouse gas emissions, water and waste management, and the use of renewable energy sources.

In short, the regulations and standards for reusable packaging aim to guarantee consumer safety, reduce environmental impacts and promote good practice in reusable packaging. Companies that produce or use reusable packaging must comply with these regulations and standards to guarantee the quality and durability of their products.
Standards applicable to reusable packaging Environmental and health regulations.

02. STANDARDS AND CHARACTERIS- TICS

EPP

List of standards, selected to form a reference for testing (expectations and limits of materials).

Standards	EPP	Principles	Links
EN 604	Determining the compression characteristics of expanded plastics	A compressive force is applied to the faces of a sample. The maximum stress it can support is calculated.	https://www.iso.org/obp/ui/#iso:std:iso:604:ed-3:v1:fr
ISO 4651:1988	Determining dynamic damping capacity	Determines the dynamic damping capacity of rigid and flexible expanded plastics by measuring the deceleration of a mass falling on a sample. The main focus is quality control.	https://www.iso.org/ fr/standard/10617. html
ISO 844:2021	Determination of compression characteristics	Specifies methods for determining compressive strength and corresponding relative deformation	https://www.iso.org/ fr/standard/73560. html
ISO 1926:2009	Determination of tensile properties	Specifies a method for determining the behaviour of rigid expanded plastics when subjected to tensile stress.	https://www.iso.org/ fr/standard/52864. html
ISO 2896:2001	Determination of water absorption	Specifies a method for determining the water absorption of rigid expanded plastics by measuring the buoyancy force on a sample after immersion in water for a few days.	https://www.iso.org/ fr/standard/30408. html
ISO 1922:2018	Determination of shear strength	Specifies a method for determining the shear strength of rigid expanded plastics. It also provides for the optional determination of the shear modulus.	https://www.iso.org/ fr/standard/60770. html

CARDBOARD

List of standards, selected to form a reference for testing (expectations and limits of materials).

Standards	CARTON	Principles	Links
ISO 3037:2013	Determination of compressive strength on edges.	Determines the on-edge compressive strength of corrugated board. It is applicable to all grades of corrugated board.	https://www.iso.org/fr/standard/60354.html
ISO 3035:2011	Determining flat compressive strength.	Determines the flat compressive strength of corrugated board used in the manufacture of shipping packaging. It applies to single-face and single-flute corrugated board.	https://www.iso.org/fr/standard/51267.html
NF Q 03-043	Method for determining the grammage of the papers making up corrugated board.	Determines the water absorption capacity of bonded paper and cardboard, including corrugated cardboard, under standardised conditions.	https://www.boutique.afnor.org/ norme/nf-q03-043/ carton-ondule- methode-de- determination-du- grammage-des-papiers-composant-le-carton-ondule/article/777621/fa006853
ISO 287:2017	Determining the moisture content of a batch. Oven drying method.	Determines the moisture content of a batch of paper and cardboard by oven drying. Applicable to all batches of paper and cardboard, including corrugated and solid cardboard.	https://www.iso.org/fr/standard/44637.html
NF Q03-052	Determination of burst strength.	Specifies a method of measuring the burst strength of corrugated cardboard subjected to increasing hydrostatic pressure.	https://www.boutique.afnor.org/norme/nf-q03-052/papier-et-carton-carton-ondule-determination-de-la-resistance-a-l-eclatement/article/664330/fa006791
NF Q 03-043	Method for determining the grammage of the papers making up corrugated board.	Defines a test method to be used to determine the grammage of the various papers used in the composition of raw or shaped corrugated cardboard after peeling. It is applicable to all types of corrugated cardboard.	https://www.boutique.afnor.org/norme/nf-q03-043/carton-ondule-methode-de-determi- nation-du-gram- mage-des-papiers-composant-le-carton-ondule/article/777621/fa006853

PLASTICS

List of standards, selected to form a reference for testing (expectations and limits of materials).

Standards	Plastics	Principles	Links
EN ISO 62	Determining the water absorption of plastics	Specifies a procedure for determining the moisture absorption properties in the thickness of flat or curved solid plastic materials	https://www.iso.org/fr/standard/41672.html
EN 604	Determination of compression properties	Specifies a method for determining the compressive properties of plastics under defined conditions	https://www.iso.org/fr/standard/31261.html
EN 175	Determining the effects of immersion in liquid chemicals	Specifies a method for exposing externally unstressed plastic specimens to liquid chemicals, and methods for determining changes in characteristics resulting from such exposure	https://www.iso.org/en/standard/55483.html
EN 178	Determination of bending properties	Specifies a method for determining the flexural properties of rigid and semi-rigid plastics under defined conditions	https://www.iso.org/en/standard/70513.html

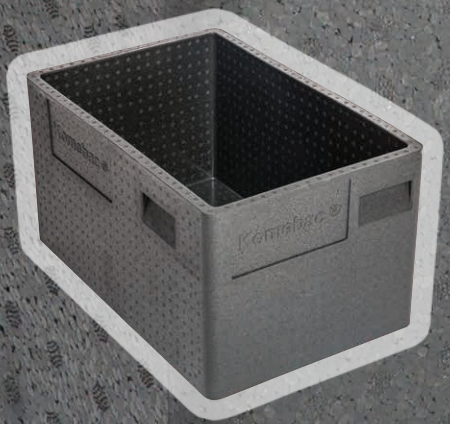
isymoov

Komebac® EPP

The lightest reusable tray on the market

lighter

than a plastic tray



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