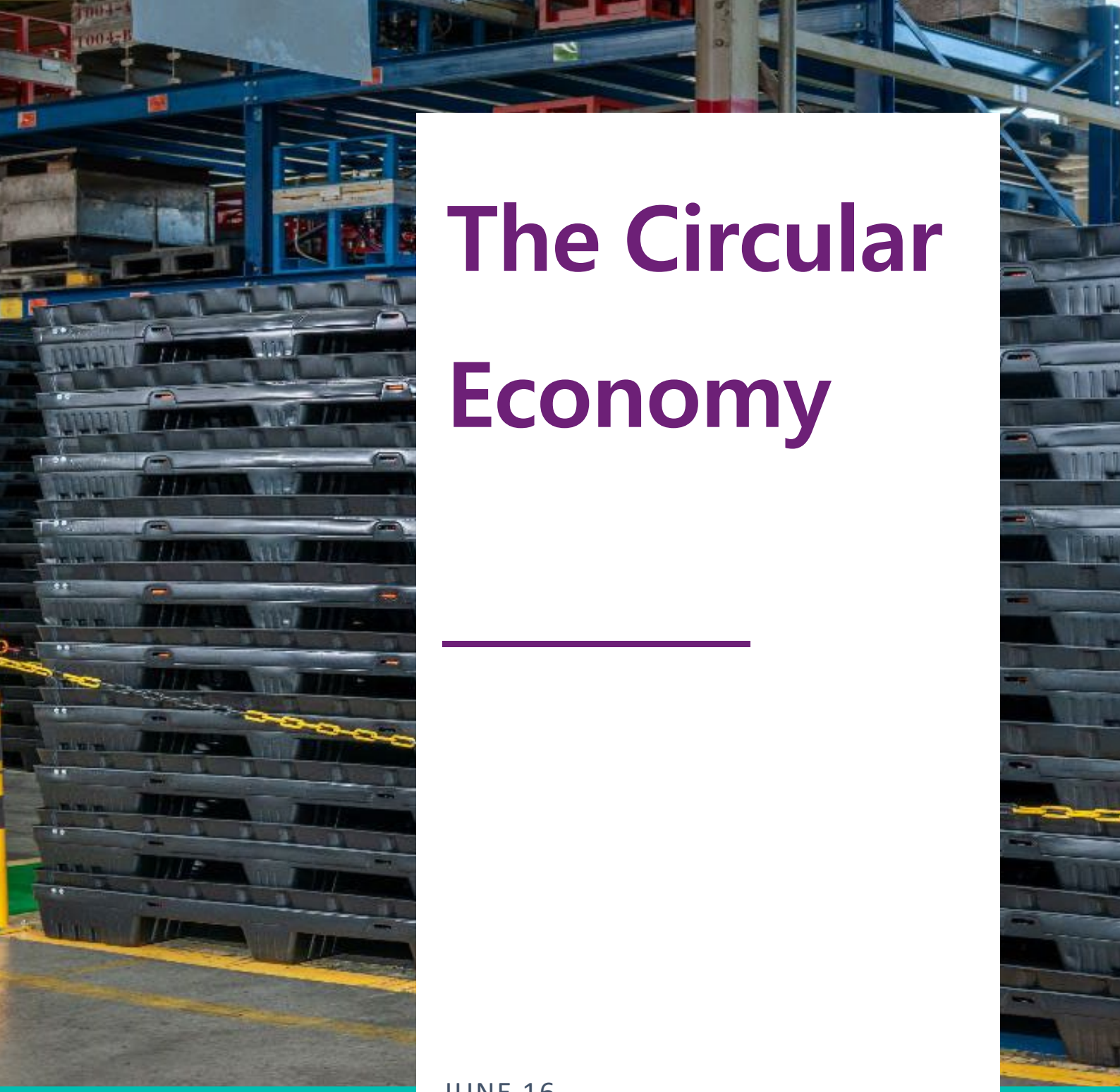

The Circular Economy

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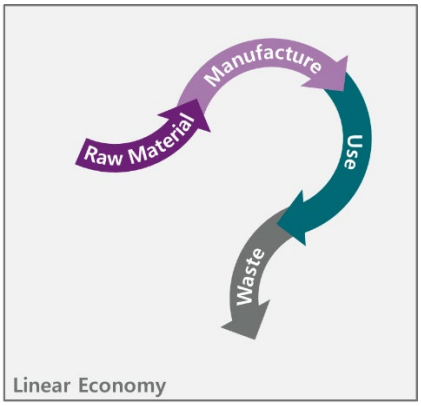
CORPLEX

VISION FOR ACCELERATING THE TRANSITION TO A CIRCULAR ECONOMY FOR PLASTICS

Our purpose at Corplex is to extend the life of plastic products through re-use and recycling. It is a purpose that positively helps the environment, makes commercial sense and reduces waste whilst

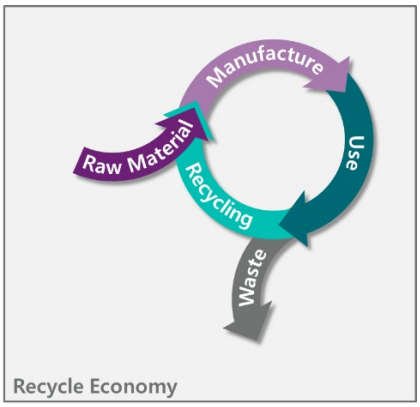
- Reducing the generation of CO_2
- Retains the value of finite materials
- Cuts the total lifecycle cost of products
- Eliminates the amount of plastic litter in the environment

Even though plastic waste is rightly demonised, we must remember that plastic itself is a fantastic material which has enabled the creation of the post-Industrial world. It is single use plastics that should be eliminated and replaced with **reusable plastics**. We need to make sure we reuse plastic products until the end of their lifespan, and only then recycle them to create the same product again. In this way we can continue to enjoy the **benefits of plastic**, a finite resource, without the environmental risk it poses when discarded. In fact, in all aspects of consumption, we should work in a **circular manner to retain** non-renewable and even renewable materials.



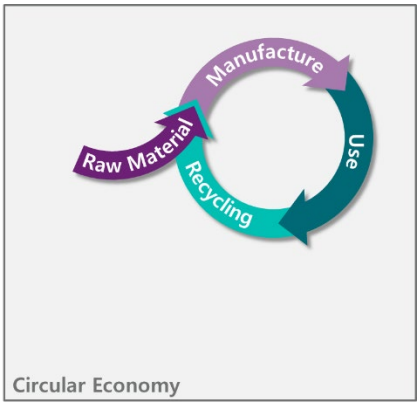
Linear Economy

The present, **Linear Economy** is simply a squandering of our resources especially in cases where these resources are not renewable and could be used numerous times. The **Recycle Economy** extends the life of the materials but generally requires the addition of virgin materials to ensure product quality is maintained. Only the **Circular Economy,** where materials are re-used to make the same item time and time again, extends the life of the materials.



Recycle Economy

This applies as much to plastic as it does to glass, metals, and fibre-based materials (of which paper and cardboard are the most common). For all these materials we must work to **maximise their reuse** and **eliminate their single use** – regardless of whether they are then recycled. Recycling is a good method of recovery and extending the life cycle, but it also results in waste and a reduction in the lifespan of the material. In isolation, it is simply not the answer. We need to focus on better systemic approaches to eliminating the wasteful use of materials.



Circular Economy

Remove

Reduce

Reuse

Recycle

Repurpose

The 5 Rs!

Eliminating waste is the key to good resource usage, particularly for packaging. First, we need to look to **remove** any wasteful material usage: does that box really **need another box around it** to ship it? Where there is a need, we should **reduce** the resource usage to the minimum: does that box really **need to be that big**? Once you have optimised product size, we should **reuse** it many times to extend its lifespan: would that box work better if it were made of a material such as plastic that you could **clean and reuse**?

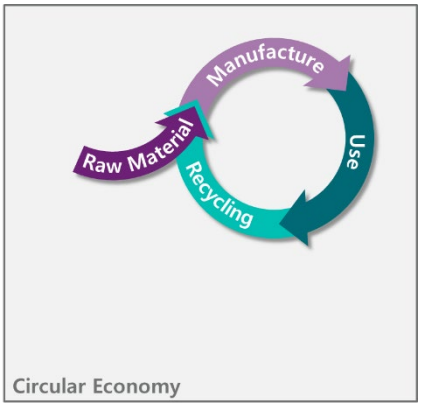
Only once the box reaches the end of its life should we **recycle**. But we should also make sure it is easy to recycle without losing its inherent quality: is the box **free from contamination** of other materials? Finally, where the materials have reached the end of their useful life, is there a way we can **repurpose** them: can we easily sort or split them, **return them to their constituent parts** through chemical recycling or repurpose them for some other use, such as energy from waste?

With the 5 Rs we focus on optimising material use, regardless of whether it is paper, plastic, metal, or glass. Each of these materials have their merits and in packaging applications it is important to choose the appropriate materials– whether that be cardboard, aluminium, glass or plastic – for the end application. However, in all cases, the objective is to **ensure a maximum reuse** of the product with a minimum use of materials requiring a minimum use of energy and water.

These building blocks drive a circular economy, one that starts with extending the life of materials used to make a product and ends up with the recycling of the materials for re-application into another product.

The Circular Economy

The circular economy has become a byword for **good material usage**. It is, after all, the model that the natural world has given us: discarded materials are used to make new materials. Indeed, ensuring **materials remain in the loop** and not replenishing materials to re-manufacture the product is a much better solution than discarding materials and then replacing them with virgin sourced materials: so-called single use materials.



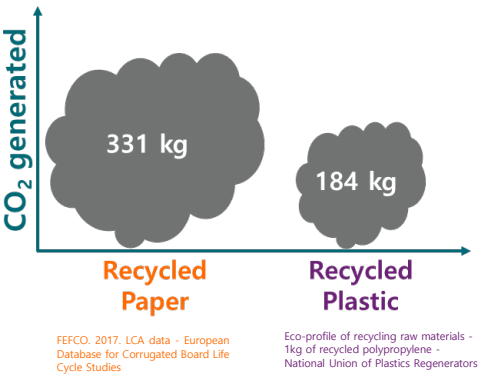
Circular Economy

Targeting the single use materials and recovering them to reuse in another product is a good application of the **circular principles** especially in those cases where this kind of circularity is not possible: some **food contact and pharmaceutical** applications presently must use materials from virgin feedstock. At Corplex we have several solutions where we take these **single use** materials from Industrial as well as post-Consumer sources and **convert them into reusable** packaging.

However, to ensure circularity we currently **focus on maintaining** the materials **in the loop** through recycling: using the same materials to make the same product again and again. This is applicable to products made from aluminium, steel, glass, plastic, or paper. However, we must be careful with classifying this form of the circular economy as the solution to our environmental issues. Even though **recycling** ensures the circularity of materials it is at a **commercial as well as an environmental cost**.

Understanding the limitations of recycling.

It is important to remember that recycling is fundamentally about **generating raw materials** that can be used in **place of new** (virgin) materials. For this to happen it needs to be of equal quality and be cost effective to produce. Where this is achieved the lifespan of recycled materials is very similar for plastics, metals, and glass, all of which tend to **retain** their physical properties over **many recycling loops** and being perfect for the circular economy.



However, we must be conscious that all **recycling is energy intensive**, requires extensive transport distribution networks and uses our water resources. Recycling aluminium, steel and glass requires temperatures in excess of 2000° C so you can imagine the quantity of **CO_2 that generates**, recycling paper or cardboard requires much lower temperatures and consequently generates less CO_2. Most significantly recycling **plastics generates 45% less CO_2** than recycling paper or cardboard, moreover, unlike plastics the process of making new paper or cardboard requires water recycling **plastics** uses **89% less water**

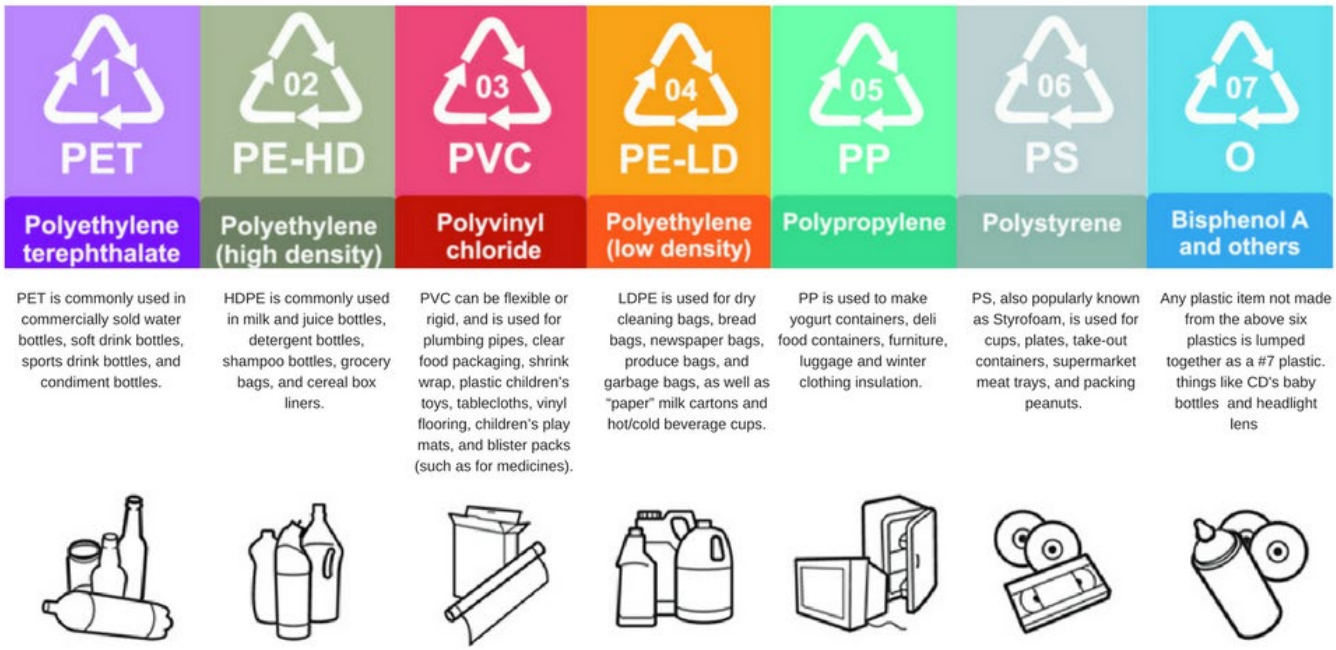
Despite this **fibre-based products**, such as paper and cardboard, presently hold an advantage in promoting the circular economy through the **fantastic collection and recycling** infrastructure in place, although there are limitations to fibre products as paper can only be **recycled** a maximum of **7 times** before the fibres become too short to be useful. In contrast recycling plastics, metals and glass do not have these limitations but these post-use materials often need **additional sorting steps** to ensure the recycled feedstock is of good enough quality to be recycled into useful raw material.

The most effective way to recycle these materials is to ensure that the materials do **not degenerate**, or the purity becomes compromised. Choosing to use so-called **"mono-materials"** makes extending the material life much easier. Not mixing materials (such as using plastic tape on cardboard boxes or using plastic liners in aluminium drinks cans) means the material can be **recycled dozens** of times ensuring a **life cycle** that runs into **tens of years**.

This is particularly relevant for the recycling of plastics as there are many different types of plastics that exist and in many cases these materials are simply not compatible. In other words, although recycling a single use plastic bottle may seem intuitive these bottles are often made from three incompatible plastics (PET bottle, LLDPE label, PP cap) resulting in **first requiring sorting** into their constituent parts before they can be recycled into a new bottle.

There are **seven commonly** used types of **plastics** and many more less used plastics. To ensure the longevity of these materials it would be best not to mix them, however the lack of current design for recycling means that more often than not post consumer materials need to be sorted into their particular elements. Sorting processes are constantly improving but it does require an additional step that adds costs and complication.

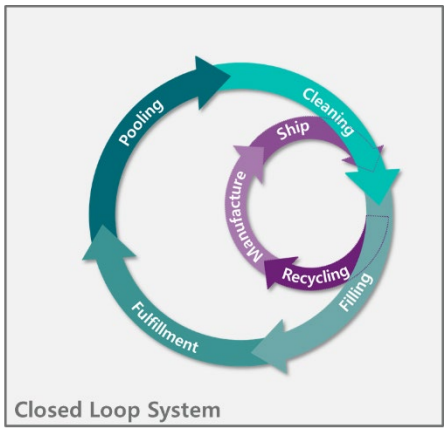
Most common types of Plastics



Despite these potential complications current **collection methods** are constantly **improving**, and advanced **sorting systems** allow ever improving purity. Also new legislation is being brought in all over Europe which will further improve our ability to develop a circular economy for plastics. The UK is the first country to introduce a **Plastics Tax** which aims to promote usage of **recycled plastics** but does not go far enough to promote the collection and use of mono-materials. Legislation that would **penalise** the use of **multi-materials** would be more helpful to promote plastic recycling rates.

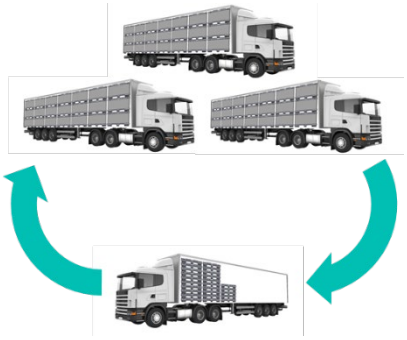
To overcome the limitations of recycling plastics, glass, and metals there are better alternatives for these materials. Introducing **closed loop and reuse systems** through deposit return schemes across the UK and all European countries would be a much more efficient use of our resources.

Closed loop Economy



The Closed Loop Economy is very similar to the Circular Economy in that it retains the materials in the loop. However, with the Closed Loop System the **materials are reused** in the same application. In the ideal scenario, the materials are recycled at the end of the first useful life, to then be made into a new set of the **same products** to be used for its **next complete lifecycle**. For instance, within two days an old plastic box used as packaging can be back in service as a refreshed version of the same box. The **materials remain** within a defined **loop** rather than being randomly distributed. By **managing** the materials and the **product design** at all stages, you can assure the purity of the materials are retained, the polymers are returned at the end of their life cycle for resale or use in another product, at which point the closed loop system starts again.

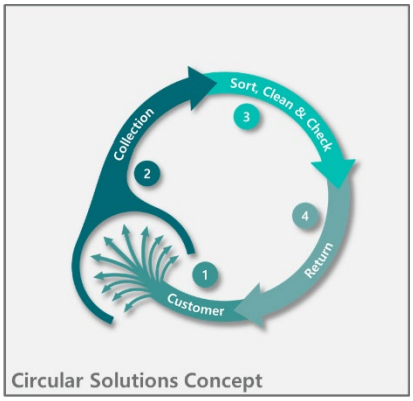
This **closed loop system** has been common practice in the **automotive industry** for over 20 years. As an industry renowned for its lean manufacturing, advanced material usage, a close eye on **cost reduction** and a sophisticated Just-in-Time and Just-in-Sequence delivery system they use dedicated delivery loops using dedicated containers to optimise their logistics costs, **generate zero waste** and reduce supply chain CO_2.



Automotive packaging developed by Corplex protects the products, **eliminates wasted space** in the box and then further optimises load factors to maximise transport space usage usually in a truck. Besides being **reusable,** this packaging is also **collapsible,** which reduces the return transport to **1 in 3**, again **reducing** supply chain **CO_2.** The boxes are the minimum weight for the maximum strength and, at the end of their **7-year lifetime**, Corplex will take back the materials to make new packaging for the same or similar customers. A good example of designing products for recycling and the circular economy as well as helping **reduce Scope 1** and 3 emissions.

Circular Solutions Concept

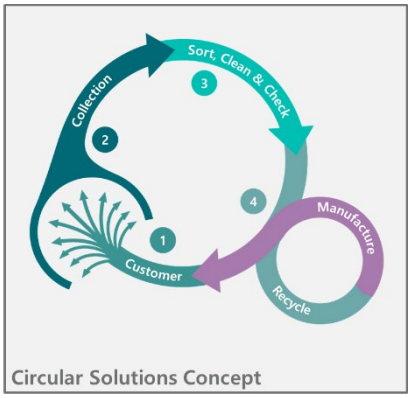
In the case of automotive packaging, this is made easy by the closed loop distribution system in place. However, where such a system is absent or deficient, a more **expansive closed loop** collection system must be developed. Existing Deposit Return Schemes, such as the beer crate system in much of Western Europe, show this as effective and environmentally responsible. When it comes to lighter weight packaging, effective collection systems need to be established to support the **transition from single use** packaging to reusable or multiway packaging.



Circular Solutions Concept

Corplex is currently working with an **alliance of partners** to set up a system to ensure the collection, sorting, cleaning, quality checking and **redistribution** of the materials for reuse. The development of durable, light weight **reusable packaging** that can be **collapsed**, easily shipped and stored and **replaces single use** cardboard materials can be managed through an infrastructure that covers four simple steps:

1. a commitment from the customer to identify the location of the products to be reused
2. a partner to collect the material
3. a partner to sort, clean and quality check the materials
4. a partner to return the materials to the customer



Circular Solutions Concept

Such **closed loop systems** can even be created for single use, tertiary packaging where hygienic regulations forbid the reuse of the packaging, such as in the **Pharmaceutical** and **Food** industries. Again, using low weight, high packing density packaging optimises both material and space use, and post use these are collected or recovered. Instead of a reuse system, the step 3 converts to a recycling step to **create materials** used in other **foldable and collapsible** transport packaging to ensure the effective **reuse** of materials. Corplex is already working with several partners beyond the Automotive industry to facilitate such solutions.

Summary

The circular economy is the way to ensure we use our natural resources intelligently. Circular Plastics represent a very good solution to lowering your CO_2 footprint where the same materials are re-used repeatedly. Applying closed Loop reuse systems further improves this situation as it also limits the impact of plastics on the environment. It is only once this life cycle has been exhausted, that we should look at recycling as a means to give the material a new life initially through mechanical recycling and in the future maybe through chemical recycling.

However, we cannot necessarily recycle our way out of trouble, there is a viable alternative through the application of a Closed Loop ecosystem. Corplex can provide this to our customers, reducing costs and the CO_2 footprint. Should you be interested in working out a solution to remove, reduce, reuse, recycle and repurpose your product or packaging, please visit www.corplex.com.