CONSEIL NATIONAL DE L'EMBALLAGE

DES PARTENAIRES POUR LE MEILLEUR DE L'EMBALLAGE

Packaging & Circular Economy

A case study of the circular economy model

Final report

Foreword: A Message From The Director

1. One of the CNE's most successful documents discusses **environmental claims**. This document is based on real examples that we divided into broader categories. These examples enabled us to illustrate, and then **highlight those recommendations**. Likewise, I don't think inventing theories on the circular economy model is useful. Some have already examined the model from all angles.

2. Moreover, as is the case with Mr. Jourdain, who was unaware of what he was writing, industries involved in packaging have already implemented the **circular economy model**. Results in **material recycling** are relevant proof thereof. Industries are not getting involved in this process out for ideological reasons but because it often makes sense from an economical point of view.

3. Since we were lucky enough not to be starting from scratch, we offered **a tangible approach through illustration** for each main material and/or packaging category from: glass to paper, cardboard, food cartons, steel, aluminum, wood, and plastic materials. This also includes the energy consumed by the different materials and the waste produced by all the different activities involved. By digesting some of the **best existing or developing practices**, we wish to **make the circular economy model a fully-fledged** part of the packaging sector.

Michel Fontaine

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1. Goals

The CNE wanted to explore the concept of the circular economy model on the one hand and apply it to packaging more specifically on the other.

Without branding it "circular economy", the packaging branch has done and is nonetheless doing a great deal in this sector. It is the perfect opportunity for all the different links in the packaging chain to highlight their best practices for primary, secondary or tertiary packaging.

In this document, the CNE will:

- Define the circular economy model in relation to the packaging sector;
- Remind readers of regulations applying to a circular economy model;
- Place consumers, citizens and users at the heart of the circular economy model in relation to packaging;
- Prove that this product/packaging combination value chain has been underway for a long time;
- Document a certain number of available practices;
- Show possible means of progression.

2. Definitions

2.1 Circular economy model definitions

According to the French ministry of sustainable development, *"a circular economy model is an economic concept referring to sustainable development. The aim of using the model is to produce goods and services while avoiding the waste of raw materials, water and energy as much as possible. It's about implementing a new economic model that's not linear but circular as it's based on "following the lifecycle" of products, services, waste, materials, water and energy."*

According to François-Michel Lambert, chairman of the French Institute for the circular economy model and French Representative for Bouches du Rhône area*, "the circular economy model focuses on keeping resources unspoiled and using them as efficiently as possible. For our institute, the circular economy model doesn't just reduce the impact on resources and their nature; it creates worth, and thus, has a positive impact on society, the economy and the environment. It enables a change from the traditional linear production scheme, in which used products simply get destroyed and waste management is a mere consequence of the production model. Instead, the circular economy model creates a loop pattern: with each step (product design, use and end-of-life), we seek solutions to create positive value by avoiding resource wastage."*

According to the French National Council for Industry, *"the circular economy model can be defined as an economic system for exchange and production aiming to increase resource management efficiency and decrease the impact on the environment with every step of products' (goods and services) lifecycles. It combines practices to save resources (materials, water, energy), prevent waste generation, increase products' life span, use eco-design for products and processes, use as many recycled materials as possible, make products easier to repair, recover/reuse materials and products and increase materials' recycling rates."*

Based on those definitions, provided that **keeping resources unspoiled** for future generations is our main goal, we must delay the likely exhaustion of non-renewable resources as much as possible. Therefore, our own circular economy model will pay particular attention to:

- saving non-renewable resources at every step of a product's lifecycle: materials, energy in the industrial process, fuel for transport, etc.
- making renewable resources **sustainable** (forest areas, for instance).

2.2 Possible definition of a circular economy model applied to the packaging sector

In the packaging sector, the circular economy model is about more than just recycling. It handles all stages of a product's lifecycle, namely: its design, production, distribution and use, but also its recovery.

It includes notions such as local integration and proximity.
It also includes saving resources (materials, water, energy), mostly through:

- Conceiving the product/packaging combination in an eco-friendly way;
- Using resources parsimoniously;
- Reusing packaging, especially on a business-to-business basis;
- Preventing packaging waste;
- Preventing product waste;
- Preventing waste by improving recyclability of products and packaging;
- Reusing materials to optimize material flow.

It also includes any and every initiative to change people's behaviour to improve packaging.

2.3 Definition of packaging

Packaging[1] means any item – regardless of the materials it is made of – used for the containment, protection, handling and presentation of goods; to enable the delivery of said item from the producer to its final user as well as ensuring said item's proper presentation. All "disposable" goods used for the same purposes are to be considered as packaging.

Packaging[2] only refers to:

1° Primary or sales packaging (I) is packaging conceived so as to constitute a sales unit to the final user or consumer at the point of sale.

2° Secondary or grouped packaging (II) is packaging conceived so as to constitute at the point of sale, a set of several sales units, whether the latter is sold as such to the final user or consumer, or whether it only serves as a means to replenish the shelves at the point of sale. It can be removed from the product it covers or protects without affecting its characteristics.

3° Tertiary or transport packaging (III) is packaging conceived so as to facilitate the handling and transportation of several sales units or grouped packaging in order to prevent physical handling and transport damage. Transport packaging does not include road, rail, fluvial, maritime or air containers.

[1] French Environment Code (Livre V, titre IV, chapitre III, section 5, Article R543-43).
[2] 94/62/EC Directive on packaging and waste packaging.

3. Regulations

Below, the CNE will digest some legal and regulatory texts applying mostly to the packaging sector. These texts have environmental or even social dimensions aiming to spread the circular economy model idea to major players in the packaging sector.

3.1 European Regulations

3.1.1 European Directive 2008/98/EC[3] on waste

It defines a legal framework and a hierarchy in waste processing, but also makes prevention the key element of laws and policies handling waste management and processing. It also acknowledges the fact that some specific waste flows do not rank in the hierarchy provided it has been justified using a thought process based on lifecycles and the effects of the production and management of that particular waste as a whole. Therefore, this regulation mainly evokes:

- ***"prevention,***
- ***preparing for reuse,***
- ***chemical, mechanical or organic recycling,***
- ***other recovery including energy recovery,***
- ***elimination[4]"***

This directive set a minimal target of reuse (through recycling) and waste recovery to be attained by 2020.
This directive also mentions Extended Producer Responsibility (EPR).

3.1.2 European Directive 94/62/EC[5] on packaging and packaging waste

This directive sets **essential requirements**[6] and states that packaging which does not abide by those demands will not be allowed on the European market. These demands apply simultaneously **to preventing waste by source reduction and taking into account the recovery of used packaging at the earliest step of its design**. This directive also sets general and material-specific recycling goals.

[3] Directive transposed in French environmental law ("Code de l'Environnement") in 2010.
[4] http://europa.eu/legislation_summaries/environment/waste_management/ev0010_fr.htm
[5] Please note that this directive was amended several times, especially through Directive 2004/12/EC, reforming and homogenizing provisions of Directive 94/62/EC.
[6] *"To limit the weight and volume of packaging to a minimum to meet the required level of safety, hygiene and acceptability for consumers; - to reduce the content of hazardous substances and materials in the packaging material and its components; - to design reusable/recoverable packaging."*
See : http://europa.eu/legislation_summaries/environment/waste_management/l21207_en.htm

3.2 French Law

3.2.1 Law 2009-967[7] also known as « Law Grenelle I »

Preventing waste production is one of its priorities[8]. In this area, national goals are:

- Reducing household and similar refuse by 7% per capita in the next five years;
- Increasing material and organic recycling to send 75% of household packaging waste and ordinary waste from companies, including industrial packaging waste, to these areas.

Extended Producer Responsibility also appears in this bill, as well as reuse, recycling, and recovery [...] as found in European Directive 2008/98/EC.

3.2.2 The French Environment Code

Sections referring to the circular economy model are L 541-1 and the following:

Article L541-1[9] focuses on design and facilitating "recovery" as well as "reducing the general impact of resource consumption and using them more efficiently."It especially favours "recycling", reuse", and energy "recovery".

Article L541-10[10] also mentions Extended Producer Responsibility:
Based on Extended Producer Responsibility, producers, importers and distributors of products or elements and materials used for their production can be required to contribute to the management of the waste it creates. *"Producers, importers and distributors to which the aforementioned requirement is made mandatory according to the provisions of the present sections and subject to said provisions must fulfil this obligation by implementing individual waste collection and processing systems for waste created by their products or by implementing common environmental organizations to which they pay a financial contribution and transfer their obligation, which they will nonetheless govern."*
Principles mentioned by European directives mostly appear in **Section V** of the **regulatory part** of this bill: **Sections R 543-42 to R 543-74**.

3.3 Non-financial reporting

The bill called "new economic regulations", passed in France in 2001, sets[11]an obligation **for companies listed** on any regulated Market to deal with the social and environmental management of their activity in their annual report.

This requirement was reinforced by **section 225 of the "Grenelle Act II" and the decree from 24 April 2012 implementing it**: they have extended the obligation to a larger number of companies and made them subject to **checks carried out by an independent organization**.

These provisions require companies to state the environmental and societal impact of their activity, which clearly belongs to the principles of the circular economy model. This law is progressively being enforced and will apply to more and more companies each year until 2017 according to certain criteria (such as revenue, number of employees, etc.).

[7] Law of the 3rd of August 2009.
[8] Article 46.
[9] Quotes directive on waste.
[10] Readers are advised to read the new version of this article once the « loi ESS », a French bill on creating a social and ethical economic model, has been passed.
[11] Article 116.

4. Current situation: Facts and figures

The packaging world has done and is doing a great deal in terms of sustainable development and implementing the circular economy model, especially through prevention, energy recovery, materials recycling and organizing events through its local presence. Of course, improving resource management and reducing the impact of packaging on the environment are never-ending tasks. Companies are constantly working to improve in those areas.

4.1 Report

4.1.1 How the changes in demographic characteristics cause consumption growth

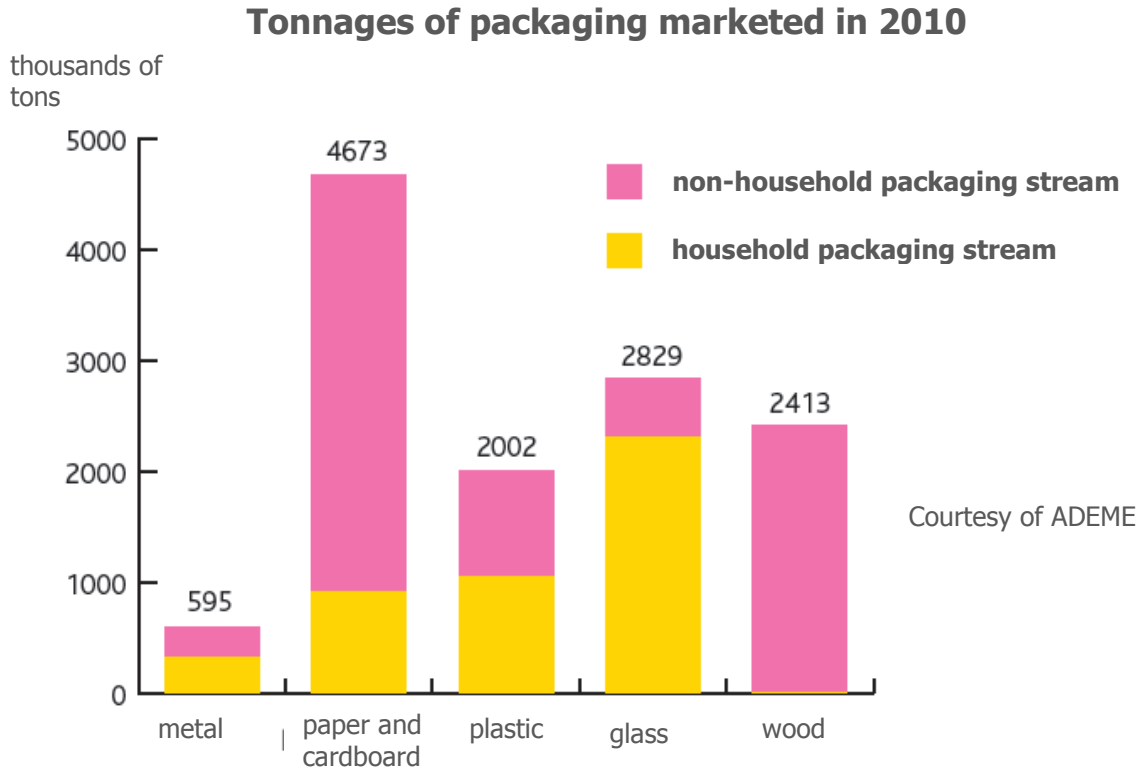
Several demographic and social factors explain the growth in consumption of packaged product units.

- Population growth in France[12] (from 60.5m in 2000 to 65.5m in 2013)
- Increased number of households in France (from 24.3m in 1999 to 27.8m in 2010).
- Reduction in the average number of persons per household (from 2.59 per household in 1990 to 2.27 in 2010), causing a reduction in the size of packaging.
- Increased number of households with only one or two persons (from 55.3% of households in 1999 to 59.7% in 2010): therefore, packaged products were adjusted to households' needs.
- Individual methods of consumption:
    - Increased on-the-go consumption;
    - Individual portions;
    - Adjustment to nutrition and health issues (referring to the French National Nutrition and Health Program (PNNS[13])).

Packaging has features serving the product, its sale and its use by the consumer, therefore those factors must be taken into account.

[12] INSEE figures.
[13] National Nutrition and Health Program.

Source of packaging on the French market

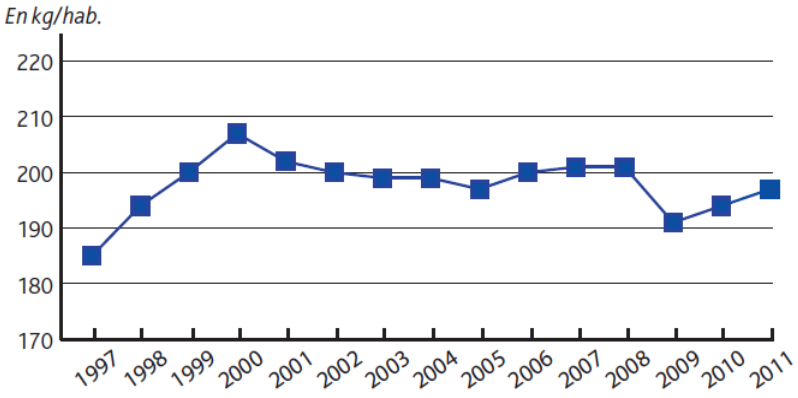


Courtesy of ADEME

4.1.2 Packaging tonnages have been steady compared with consumption growth since 2001[14]

Until 2000, the average consumption of packaged products per capita was rising continuously. Combined with population growth, packaging tonnages marketed in France were increasing by 2.7% on an annual basis.

Since 2001, the ratio of packaging (of all types) consumption per capita has remained steady around 200kg per capita per year (see graph below). This is especially due to efforts made to reduce the quantity of packaging used for the same features (see catalog of prevention cases on the CNE website). It is also linked to the increasing share of the lightest materials.

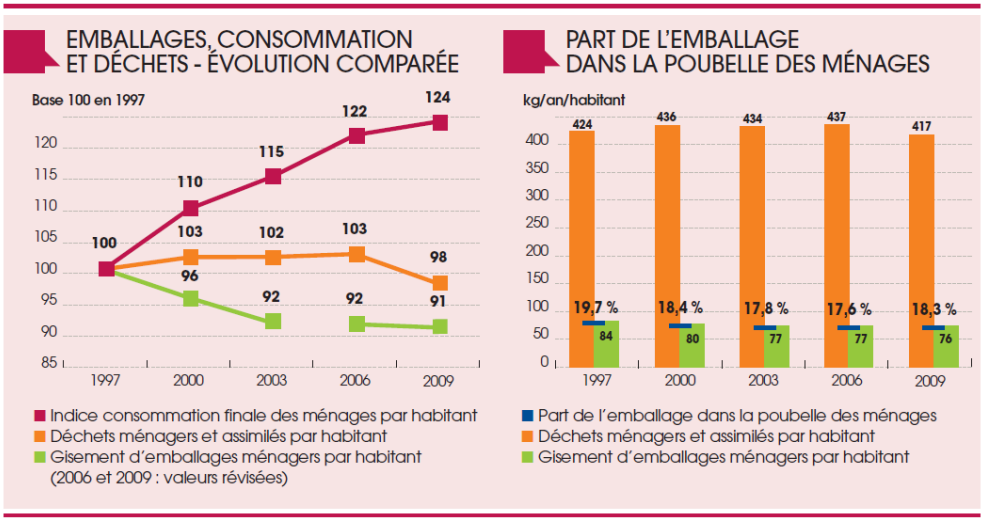


Courtesy of ADEME

[14] Industrial, commercial and household packaging, courtesy of ADEME 2011.

Whilst the quantity of household and similar refuse per capita[15] remained more or less steady between 1997 and 2009 and slightly decreased between 2006 and 2009, the quantity of **household packaging** put on the market shrunk between 1997 and 2009. Therefore, the change in household packaging production no longer corresponds with the change in consumption, which shows that a substantial amount of non-renewable natural resources were saved compared with the growth in economic activity.
The share of household packaging in household and similar refuse (residual household refuse and separate collections) has decreased from 20% to 18% between 1997 and 2009 in terms of weight.

Change in household packaging per capita

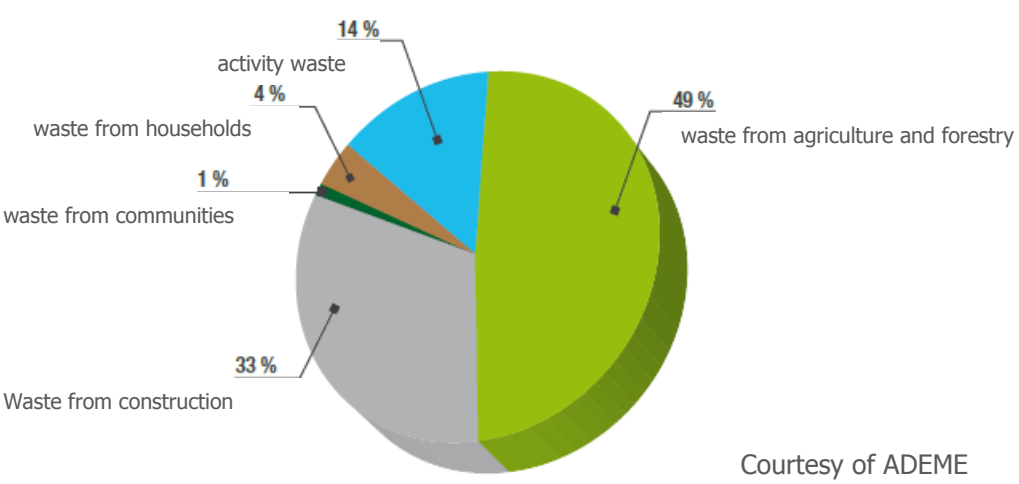


Courtesy of ADEME

4.1.3 Household waste and packaging are only a minor part of total French waste production[16]

Household waste only amounted to **4%** of the 770 million tons of waste produced on a national scale in 2009.

percentage of total waste produced by each sector in France



Courtesy of ADEME

In 2011, 12.8 million tons packaging was put on the market. Part of this tonnage is reused. Waste from non-reused packaging is less than **1.6%** of the total amount of waste produced in France.

[15] « Gisement des emballages ménagers en France, évolution 1994-2009, ADEME/Eco-Emballages/Adelphe ».
[16] Waste figures for 2012 – Key figures – courtesy of ADEME.

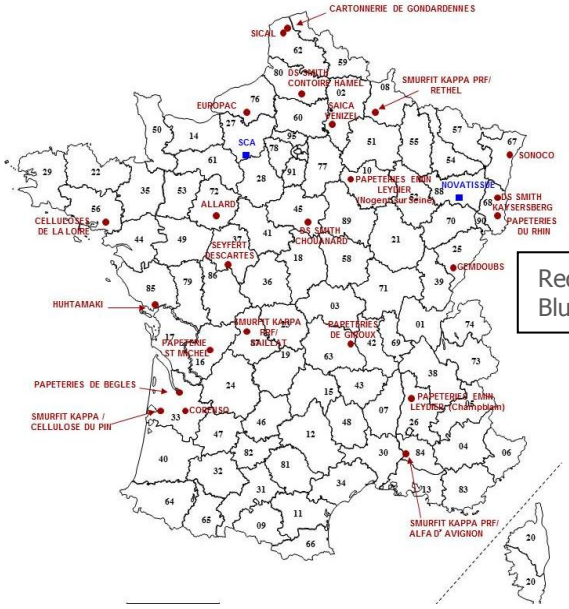
4.2 The Circular Economy model already has a heavy influence on the packaging sector

4.2.1 The packaging value chain: production and recycling are economic activities that enable local presence

The packaging industry in general is an economic activity responding to local areas' needs. The local presence is due to historical and economic reasons.

- **For example: where purchasers of Revipac registered paper and cardboard are located (Sept 2013)**

Purchasers of recycled paper and cardboard packaging produce raw material for cardboard packaging producers. These companies are spread out all over France and deliver to packaging companies near their locations.

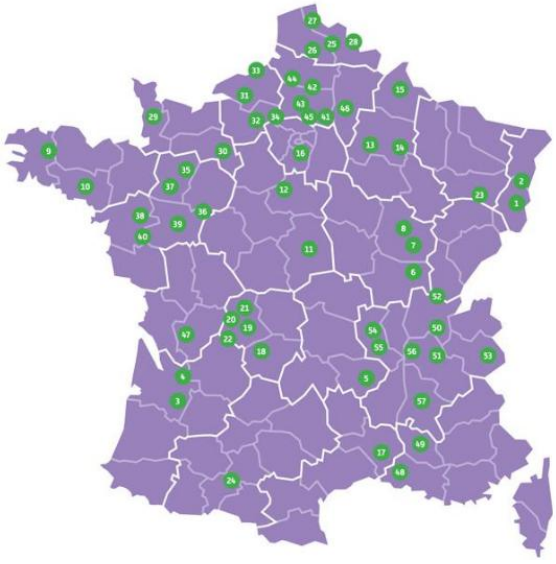


Red dot: recycling plant for PCNC
Blue dot: recycling plant for PCC

Courtesy of Revipac

- **For example: production sites for corrugated cardboard packaging** (in green on the map)

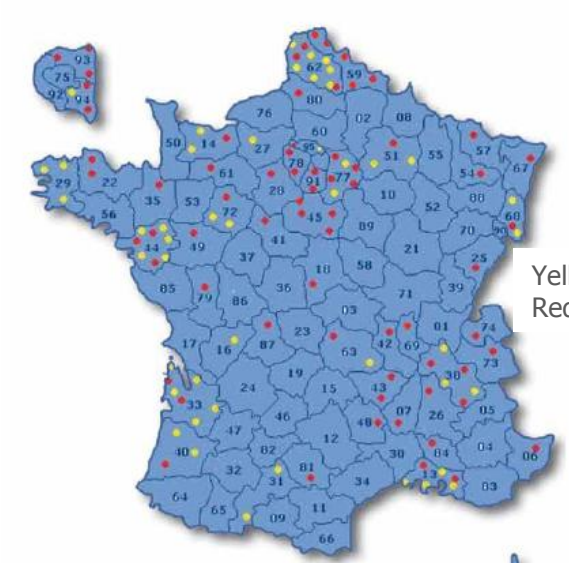
The corrugated cardboard sector has 73 production sites all over France, thus ensuring its local presence and importance in the economy and society. Indeed, production sites are well connected to ensure proximity with the client.



Courtesy of Carton Ondulé de France

- **For example: collectors and reconditioners of pallets and wooden packaging**

The number of professionals involved in this sector reduces distance as well as financial and environmental costs.



Yellow dot: pallets only
Red dot: pallets and wooden packaging

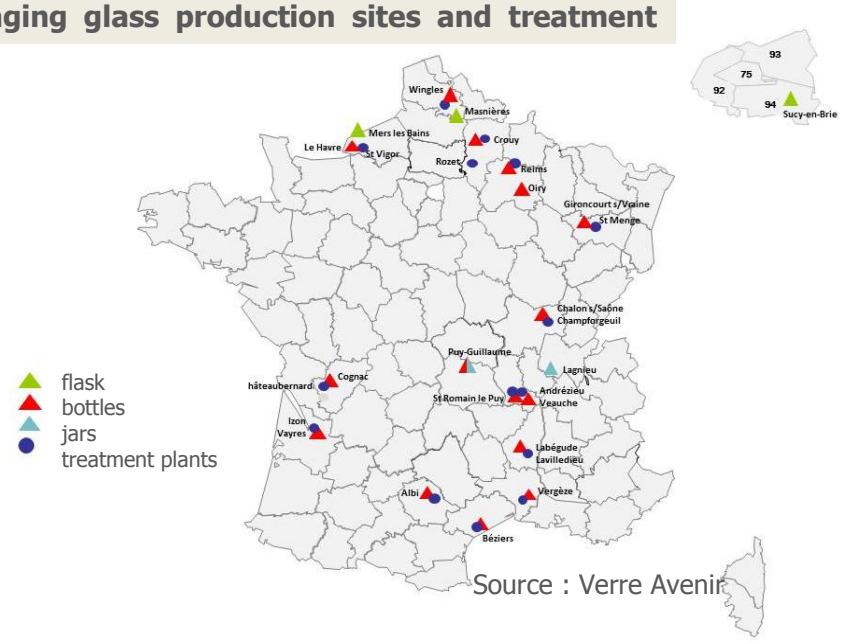
Courtesy of Sypal

- **For example: glass-making sites**[17]

It is a dynamic sector with over 15,000 employees across France, including 1,600 jobs linked to glass recycling (collection and processing).

Glass-makers provide for a wide range of clients: from large multinational agri-food companies to perfumery, cosmetics, and even independent wine-makers. Therefore, there is a strong demand for glass packaging to be distributed all over France. That is one of the reasons why France has a strong network of 20 glass-making plants. The average distance between a plant and its clients is 300km. 90% of packaging produced in France is also used in France. As for raw materials (cullet, sand, sodium carbonate), 95% of them are produced in France. The distance between their place of collection, extraction or production and glass-making plants, where they are processed, is as short as 300km on average. The French glass packaging industry has developed according to the principle of proximity, thus ensuring minor transport-related impacts on the environment, and the objective has always been to supply plants with raw materials or to deliver products to clients.

Packaging glass production sites and treatment



Source : Verre Avenir

[17] Courtesy of Fedeverre.

- **For example: plastic packaging recyclers**

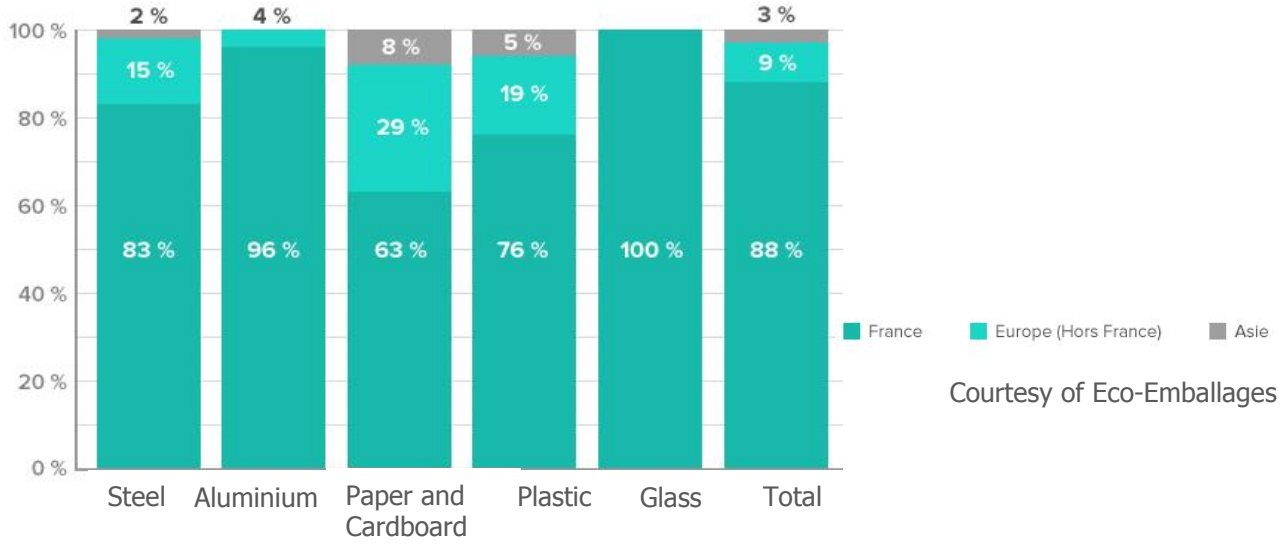
Used plastic packaging recyclers are building a network through the establishment of over 70 sites in France, thus ensuring recycling's local presence. This area created jobs: there is an average of one employee for every 400 tons of packaging waste recycled. Improvements have been made to the collection process on a quantitative as well as a qualitative scale. Indeed the collection process is a key element in helping to spread recycling best practices and the jobs created as a result.

Courtesy of Elipso

4.2.2 Packaging recycling: an economic activity based on reusing materials that is mostly beneficial on a local level

The recycling of packaging is also a local activity. The materials produced from the process are mostly reused on a local scale (in France) and possibly on a regional scale to a lesser degree (in Western Europe).
For example, the following graph explains the geographic destinations for recycled materials from household in the Eco-Emballages system.

Destination (percentage of tonnages) of recycled materials produced by the Eco-Emballages system



Courtesy of Eco-Emballages

4.2.3 Eco-design[18]: a crucial lever used to improve packaging

Eco-design is a process[19] implemented by companies which consists in taking the environment into account from the first product design phase and onwards. It aims to reduce the products' negative impact on the environment throughout its lifecycle (raw material extraction, production, distribution, use, and destruction) while maintaining the same level of quality (same performance and/or level of efficiency). It is based on a general approach which is broken down into several steps with multiple criteria. Thinking of the product/packaging combination's entire lifecycle enables one to optimize performance at every step, thus preventing extra pollution or harm to the environment in between steps.

In relation to the circular economy model, eco-design:

- Develops products that will cause as little impact to the environment as possible;
- Rethinks existing products as well as the way they are distributed or used;
- Identifies and masters risks/costs associated with the product's entire lifecycle;
- Is a source of optimization of/reduction in transport costs, raw materials and packaging;
- Enables thinking ahead, considering possible ways of recovering materials;
- Adds value.

[18] Eco-design and Packaging: Methodological Guide by the CNE-March 2012.
[19] ADEME definition.

4.2.4 Reusing[20] packaging[21] in a circular economy model

Directive 94/62/EC defines reuse as "*any operation by which packaging, which has been designed to accomplish a minimum number of trips or rotations, within its lifecycle is refilled or used for the same purpose for which it was designed, with or without the support of auxiliary products present on the market enabling the packaging to be refilled; such reused packaging will become packaging waste when no longer subject to reuse.*"
The norm EN 13429 "packaging-reuse" specifies requirements that packaging has to fulfil to be classified as reusable and lays down procedures to assess conformity to said requirements.

The various types of packaging mentioned hereafter highlight the significant impact of reuse on preventing waste production: without reuse, there would be (wooden pallets not counted) 1 to 2 million tons more non-household packaging waste, i.e. between 15% and 30% more.

Producers consider nearly all wooden pallets as reusable several times based on the product's nature (after reconditioning, in most cases). There is a substantial stock of wooden pallets (an estimated 300 million units, i.e. about 1 billion movements or rotations per year).

200-litre larger steel barrels are reusable for an extremely high number of rotations, with or without renovation. An estimated 5 million new barrels are put on the market every year in France.

Marketable beer volumes in France come in Brewery steel barrels (20 to 50 litres) and are made to be used in cafés, hotels and restaurants. Their stock amounts to 3 million units which are completely reused. They are used 53.5 times on average throughout the packaging's lifecycle. In France, brewery barrels[22] are the most common form of packaging for beer.

Boxes with a pallet base and plastic pallets have a stock of only about 100 million units and are part of many reuse processes, especially for fruit and vegetables, boxes for bottles, and less specifically for the agricultural and food industry. However, they are also used in the automotive sector, and sometimes in other industrial branches.

Glass bottles containing drinks for cafés, hotels and restaurants have a stock built up of nearly 1 billion reusable bottles.

Barrels, IBC[23] and 60-litre+ plastic big bags are reused depending on the product contained within. These types of packaging are prepared by industrial waste recovery professionals to be reused efficiently while preventing contact with food.
Reuse currently is the number one way of recovery for collected barrels and IBC with a share as high as 41%.[24]

returnable packaging for household-related packaging[25]: according to ADEME, given the environmental studies available, the establishment of widespread measures making the instructions an obligation does not seem justified, whether for reuse or recycling purposes.

[20] Reuse in the sense thought by the norm NF EN 13429.
[21] Reuse of industrial packaging, national technical seminar on 18 November 2010, ADEME.
[22] Why are products packed the way they are? CNE – September 2013.
[23] Intermediate Bulk Container.
[24] Courtesy of Elipso – Elipstat study (2012).
[25] ADEME's technical form: returnable packaging for drinks beverage – November 2011.

4.2.5 Recovery through material recycling[26]

Reusing materials is the key to recycling within the framework of the circular economy model. Reusing materials prevents further damage (to the environment, using new, previously unspoiled materials) and provides society with value by creating new recycled products.

7,8 million tons of packaging waste was recycled in 2011.

3.1 million tons of packaging waste was recycled by the household packaging stream and 4.7 by the non-household packaging stream: recycling has become the main waste management method.

In 2011, recycling accounts for 61% of packaging waste tonnage (or 66% excluding wooden pallets), compared with less than 40% in 1997. This change can be explained mainly by an increased separated glass collection, separated light household waste collection and industrial paper/cardboard collection, and to a lesser extent, by industrial plastic and wood collections.

Changes since 1997

- **85% increase in recycled tonnages**

The amount of recycled packaging in France increased by 3.6 million tons between 1997 and 2011, i.e. an average increase of 5% a year.

40% of increased recycled quantities are the product of household separated waste collection. Implementing this type of collection over the whole country increased the amount of selected light packaging (metals, paper-cardboard, and plastics) from 120.000 tons to 950.000 tons. During the same period, the separated collection of glass, which was already well implemented in 1997, increased by 610,000 tons.

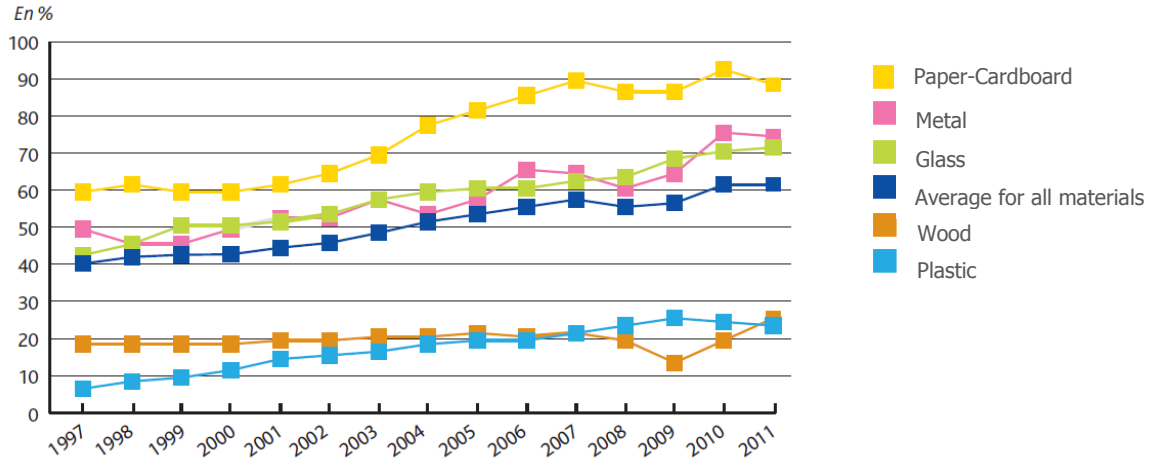
Simultaneously, the recovery circuit of industrial packaging continued to develop using professional organizations as a platform, and thus increasing the amounts recycled, including circuits with high recycling rates.

- **Increase of recycling rates for all materials**

Over the last ten years, the stabilization of tonnages on the market and the increase of quantities recycled led to a significant increase in the recycling rate for all materials.

Since 2009, plastics have reached a certain stability around 23%. Regardless of the material, the recycling rate significantly increased between 2002 and 2007 (+ 2% per year in average).

Évolution des taux de recyclage des emballages



Courtesy of ADEME

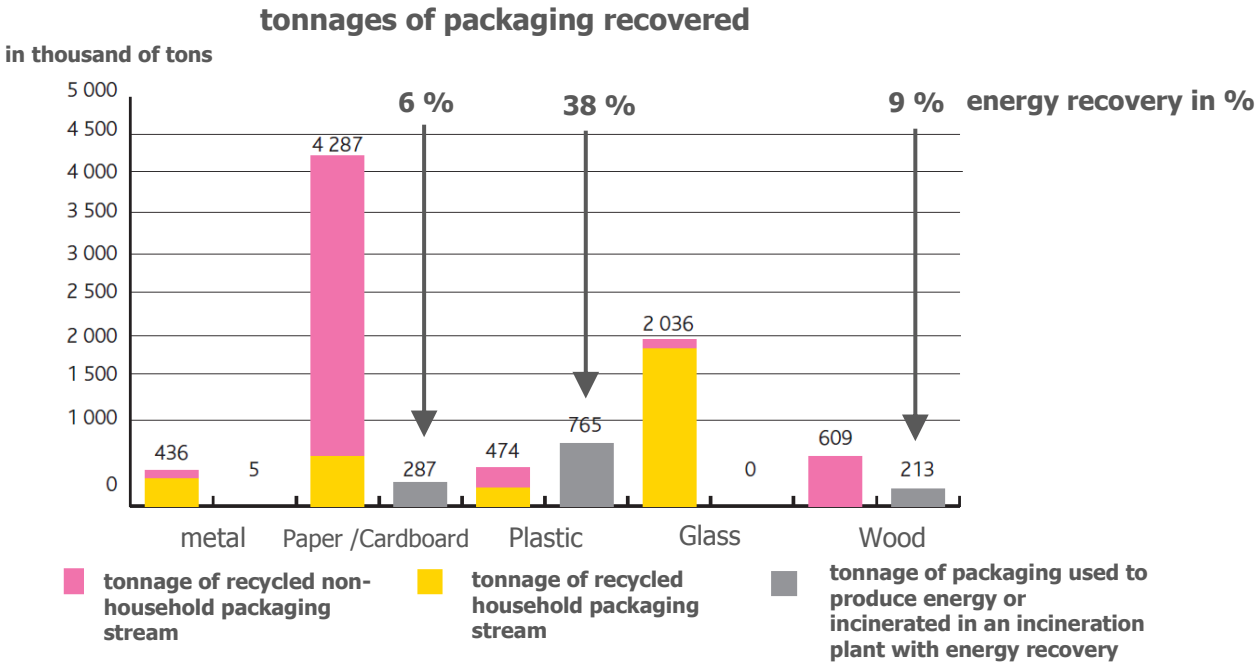
In conclusion, the material resource derived from packaging is mainly used in material recycling where waste becomes a resource meant to make:

- a new packaging for the same use,
- other products for other uses.

[26] Emballages industriels, commerciaux et ménagers, Données 2011 ADEME.

4.2.6 Use of waste as an energy source

The use of waste as an energy source is the way to go when matter cannot be reused.
In 2011, 1.1 million tons of waste were used to produce energy or incinerated in an incineration plant with energy recovery (it concerns plastics, paper-cardboard, wood and for metals, aluminum films of less than 50 microns thick).



Courtesy of ADEME

5. Best practices

The CNE wanted to publish a certain number of best practices of the packaging industry players for they are unknown to the public. This document is a good opportunity to show what has been done and what is done for the common good.
These best practices gather information that will allow to progress, to adjust, to get better and to go in the right direction.
By spreading these best practices, the CNE hopes to help establishing the importance of the circular economy model in the packaging industry and thus triggering new virtuous initiatives.

Circular economy and material resources

1. Paper/cardboard packaging

- **Forest management of the resource**

The sustainable forest management goes together with an optimal use of the natural resource. In Europe, the paper-cardboard packaging industry generally only uses forest or sawmill waste to prevent it from being wasted. Thus, it ensures the sustainability of its renewable natural resource (wood). It also makes sure that it is optimized particularly thanks to massive reuse, by recycling its cellulose fiber.

Therefore, in the case of carton, the cardboard comes from forests mainly located in Scandinavian countries, especially in Sweden and Finland. Good forest management is a major issue for these countries and for the carton packaging industry to ensure the renewability and **the durability of this resource** and of industrial sectors. Thus, in 2013, the increase in forest volume exceeded wood cutting by more than 30% (104 million m^3 of growth against 79 million m^3 of wood cutting, in Finland, for instance).

Forest exploitation is oriented towards wood industries (big trunks and branches are used for construction and furniture). Besides, it is willing to use all the tree components, therefore the smallest components can be used to make paper pulp while barks and wood residues can be used to produce energy. Carton Packaging production plants thus use more than 96% of renewable energy.

European forests, just like French forests, grow larger every year. Thus, in the case of light wooden packaging that use only French woods, it should be pointed out that French forests cover 16 million hectares and that wood cutting only accounts for 60% of its natural increase. The use of wood in industry, including packaging, contributes to the **forest economy** and **to the forest development**.

Finally, resource traceability being crucial, cardboard suppliers made an exemplary commitment in 2007 with the FSC[27] certification. As for the PEFC[28], certification, it is the result of a consultation process between all the players of the civil society concerned by forest sustainable management – farmers, processors and users.

[27] Forest Stewardship Council.
[28] PEFC: Program for the Endorsement of Forest Certification schemes.

- **Recycling paper-cardboard packaging**

Paper-cardboard packaging[29]
Waste packaging is collected separately and sorted so that the products are homogenous and fit for recycling. Recycling consists in extracting the cellulose fibers packaging is made of to reuse them to make recycled paper or cardboard. This material is then used to make new packaging. The matter contained in used packaging starts a new useful life instead of being destroyed, and the matter cycle is complete.

More than 80% of the matter used in the cycle comes from used packaging. The paper-cardboard packaging industry use a cellulose fiber that is used successively and repeatedly. In practice, a fiber serves more than 5 times in average to make new packaging. Thus, the industry takes as little as possible from the nature to meet packaging needs. Very little matter is lost, especially since it is linked to the collection and recovery system (non-recycled or dirty packaging, etc.). These non-recycled used packaging is then used to produce energy or organic matter to enrich soils. The compensation of the system's losses, as well as the growth of the general cycle, is ensured by the introduction of new fibers, from renewable and sustainably managed natural resources. Besides, "used non-packaging paper products" are also introduced in small amounts, their fibers end their lives in the packaging cycle.

The paper-cardboard packaging industry managed to develop an almost closed cycle, since more than 4 items of packaging out of 5 are recycled[30], which is much more than the targets fixed by the Directive 2004/12/EC. By creating a virtuous cycle where used packaging becomes a resource, this industry is a good example of the circular economy model.

The industry is working on even more recyclability processes:
Eco-Emballages and Revipac (recycling body responsible for the EPR [producer enlarged responsibility] process) created the CEREC[31], to assist and approve of the choices of designers and users of paper-cardboard household packaging in terms of eco-design and recyclability improvement. As for the paper industry, it committed itself to implement the means to ensure, in the market conditions, the recycling of end-of-life products (R&D, development of technologies and skills).

During the various recycling operations, the matter will be reused and converted into different products, with no technical or use limits.

[29] Source: Revipac.
[30] 85.6% recycling rate and 95.5% reuse rate – Year 2012
[31] Assessment Committee for the Recyclability of Paper-cardboard Packaging

Carton Packaging[32]

In France and in Europe, carton packaging is recycled by paper manufacturers. They extract cardboard fibers to make packaging or wiping products, thus giving a **second life** to the cardboard of carton packaging. The other components of carton packaging, accounting for about 25% of the packaging, are recycled or reused in different ways depending on countries, recyclers and technologies used by paper manufacturers.

In Europe, several paper manufacturers developed pyrolysis plants to gasify the plastic that will be used to produce energy or electricity to supply their factories and to make pure aluminum "plates" that will be recycled. This technology was implemented, for instance, abyStora Enso, near Barcelona, Spain. This factory collects part of the French used carton packaging.

In France, the recycling of polyethylene and aluminum is based on the sintering of these two materials to make plastic pellets with a few aluminum particles. They can be used to make street or garden furniture, or vineyard posts.

The existence of various technologies used by paper manufacturers mainly depends on their recycling capacity and on the stability of their collection volume that will allow them to make the necessary investments.

[32] Source: ACN.

2. Wood[33]

Wooden packaging sector is divided into 3 families, **pallets, industrial packaging** and **light packaging** (crates, trays, hampers, boxes etc.) and together they represent a turnover of over 1.1 billion euros, creating 18,000 industrial jobs in rural areas.

Let us take the example of light packaging; 7 parameters contribute to the circular economy model:

a. The resource: compliance with the PEFC standard specifications.

b. The resource: it takes 17 years before a poplar is ready for use, but even though the renewability process is quick, the industry must ensure the durability of the resource. We can have a vague approach of European forest surfaces, which already says a lot - the forest is expanding - but is insufficient. We can also get into specifics, with rigorous specifications such as PEFC's, which is now very frequent (see 1). But we can go even further by supporting replanting.

   Light wooden packaging corresponds with the circular economy model and created the charter:

   It is a voluntary approach aimed at financially supporting replanting. This massive operation was launched in France in 2014, after a first successful regional launch in the West region of the country. Industries financially support forest owners to help them replant, only when it is effective. To close the cycle, the wood industry manages the durability of its resource in the medium and long term, by ensuring that the trees are actually planted.

c. Manufacturing: Manufacturing in an **energy efficient** industrial process (peeling + stapling).

d. Energy consumed in the process: use of sawmill residues (renewable resource) to produce energy. At this stage, the **carbon footprint is low**: 72keq CO_2 [34] per ton of packaging out of the factory (figures France - Qualisud Siel).

e. Transport energy: Light wooden packaging players are **located near their clients** to reduce the use of fossil energy linked to transport.

f. End-of-life by material recycling: wood can be used to make **particle boards,** thus extending its lifecycle by many years (construction work), or to make mulching or firelighters, etc.

g. End-of-life by energy recovery: packaging and particle boards are burnt in **local wood-burners** or incinerators to generate energy.

[33] Source: SIEL.
[34] CO_2: Carbon dioxide, a greenhouse gas.

3. Glass

The container glass industry is committed to the circular economy model, be it in terms of prevention by source reduction, material recycling or industrial ecology.

- **Prevention by source reduction**

The example of the Champagne bottle

In 2010, the CIVC[35] implemented a chart suggesting the Champagne industry could reduce its carbon footprint by 25% by 2020.
The reduction in the Champagne bottle's weight **from 900 g to 835 g** in 2010 was one of the major actions of this commitment. This weight reduction is the best reduction possible without making any real alterations to the bottle's dimensional characteristics.
Glass-makers guarantee that this 835 g bottle has the same mechanical performances as those of the current 900 g bottle.
This collective effort of source reduction was followed-up by glass-makers for other bottles. These optimizations are available on the CNE's and Eco-Emballages' prevention cases catalogues.

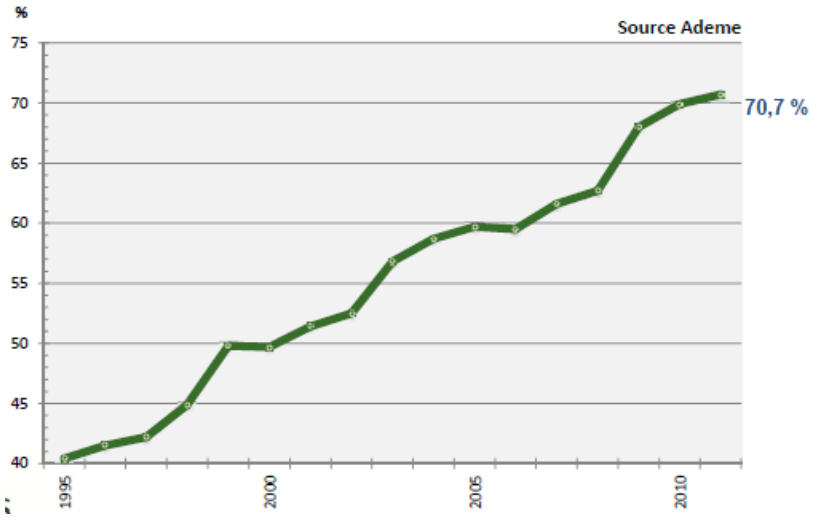
- **Recycling glass packaging**

Today, more than **7 bottles out of 10 are recycled**. The cullet (recycled glass) now represents the first raw material of the glass industry, accounting for over 63% of the materials used in the manufacturing process. Some glass furnaces work with more than 90% of cullet.
In 2012, more than two million tons of glass were collected and recycled.

This recycling can be used to [36]:

- **save up energy**: a 10% share of recycled glass used instead of virgin raw materials can save up 3% of energy,
- **limit CO_2 emissions**: one ton of recycled glass prevents the emission of more than 500 kg of CO_2 (CO_2 emissions decreased by 17% between 2005 and 2011 by ton of glass produced),
- **limit the extraction** of natural resources: for each kg of cullet used instead of raw material, 1.2 kg of virgin materials is saved,
- **optimize logistics** and therefore decrease the carbon footprint linked to transport. The recycled glass comes from local collection areas close to the factories.

Change in glass recycling rate in France



Nota: Recycling rate in 2012: **74%** (source: ADEME)

[35] Comité Interprofessionnel du Vin de Champagne.
[36] Courtesy of Verre Avenir.

- **Glass and energy**

Project [37] **of a glass-maker container (Verallia) and the partial substitution of a fossil energy for a renewable energy.**

The circular economy model relies on closing off matter in flux. Ensuring that waste can become the resource of an economic player is an ambitious initiative that is about to become reality in the glass industry and for one of its key products: Champagne.

Verallia and its partners on the project carried out studies to determine whether the energy produced (from a synthetic gas) from the biomass generated by Champagne vineyards (woody by-products from vine pruning and uprooting) could supply a glass furnace and partially replace fossil energies.

This **industrial ecology** concept leads to:

- A **mutual involvement** of economic players,
- A **circular economy model in a given zone**,
- A **reduction** in plants' fossil carbon dioxide **emissions**,
- The creation of an **integrated industry** of biomass recovery.

Therefore, the wine that produces Champagne will be used to produce part of the energy necessary to make the bottles in which it will be sold.
In the long term, we can imagine a fossil energy substitution rate of 50%.

More generally, Research and Development programs also aim at improving glass furnaces design and encouraging the use of renewable energy sources (biomass, photovoltaic) by industry.

[37] Verallia Sustainable development 2012 catalog.

4. Plastic

Optimal use of resources is a major parameter in the design and production of plastic packaging. Indeed, considerable efforts are made to reduce packaging waste, the recovery of used packaging is taken into account at the earliest step of their design, and innovating and complementary materials are being developed. All of these are examples of eco-design actions carried out by the industrials of the packaging chain.

23% of used plastic packaging are collected, sorted and recycled. The matter produced by recycled waste meets precise technical specifications to be integrated into new products, including packaging. Plastic producers, packaging manufacturers, packaged products marketers, collectors and recyclers have been committing for more than 20 years to develop recycling together, with Eco-Emballages for household packaging and organizations such as Ecofut, EcoPSE and Recyfilm for industrial and commercial packaging.

The industry also supports the development of packaging reuse, when it is relevant, of biodegradable packaging industrial composting and of high-efficiency energy recovery. The aim is to prevent plastic packaging from ending up in landfill sites.

The example of PET[38] bottles

PET bottles are mainly used for beverages (water, juice, soda…) but also for liquid non-food products (cleaning products, soap…).

- **Eco-designed bottles**

The reduction in bottles and caps weight is a reality. For example, still water bottles went down from 40 g to 25 g on average since the early 2000's.

Since 2001 the COTREP (Technical Committee for the Recycling of Plastic Packaging) has published 96 recommendations to help companies to take into account bottles recyclability from the design step (www.cotrep.fr).

Bottles can be made out of:
- PET, its environmental impacts were reduced by more than 20% in 20 years,
- Recycled PET, 25% on average in bottles containing recycled matter, and/or
- Biosourced PET, 30% of which is produced with sugar cane.

- **Recycling of PET packaging: the example of APPE/Coca-Cola Infinéo**

With 7 recyclers in France, the recycling of PET household packaging is a reality. Each year, it allows various companies to locally produce polyester fibers (49.7%), new bottles (26.8%), trays (19.1%), and various products (4.4%).

In 2013, APPE (PET packaging manufacturer and recycler) and Coca-Cola Enterprises created the joint venture Infinéo to develop the recycling of PET packaging and raise awareness regarding waste sorting and recycling, to turn waste into a useful resource. This initiative is a good example of the partnership work that the players in the packaging chain can achieve together. Thanks to Infinéo, the recycled PET suitable for food contact increased from 28,000 tons to 48,000 tons produced at the Beaune (21) plant.
It is also the first pedagogical center dedicated to an all packaging circular economy model. It raises awareness of waste sorting and recycling among young people and will help to change behaviors in the long term.

[38] PET: Polyethylene Terephtalate.

5. Metals

➢ Recycling of steel packaging

Steel for packaging corresponds with the circular economy model approach.
First of all, prevention and eco-design are major parameters in steel production, the objective being to relentlessly reduce the environmental footprint of steel packaging. Over the past 30 years, the reduction in the thickness of steel for packaging, as well as the optimization of its mechanical properties, successfully led to a 40% reduction in the weight of steel packaging, thus contributing, just like recycling, to an efficient use of resources.

Indeed, recycling is, by nature, one of steel's major assets. This material can be 100% recycled, endlessly, without losing any of its intrinsic properties. Whatever the origin of scrap irons, they can be indefinitely recycled, thus contributing to the production of a new steel that will be used in various products such as cars, household appliances, construction and packaging, while contributing to a responsible management of resources.

Therefore, scrap iron recycling contributes to preserving resources:

- A ton of recycled steel saves up more than twice its weight in raw materials: 1.5 tons of iron ore, 0.65 ton of coal and 0.3 ton of lime.
- It also saves about 70% of energy.

Steel is a permanent material and 80% to 90% of the steel produced is still being used today.

Recycling steel also influences the decrease of environmental impact:

- A ton of recycled steel saves 1.5 times its own weight in CO_2, which is to say over 4 million tons of CO_2 in Europe, which means a recycling rate of 74% for steel packaging in 2012.
- A 9% decrease in greenhouse gas from 2010 to 2012, with 2.33 kg of CO_2 equivalent for 1 kg of steel packaging.
- Acidification and eutrophication: over the last two years, acidification and eutrophication have dropped by 6% and 11%, respectively, for 1 kg of steel packaging.

The circular economy model concept also translates into the creation of an economic and social model spanning steel packaging from its creation to its recycling, both activities being at the heart of the industry.

➢ Aluminum packaging recycling

Aluminum is an easily recyclable material, and it can be recycled indefinitely. It does not lose its inherent mechanical properties following the recycling process. Aluminum recycling can help save up to 95% energy and 70% water compared with the quantities used when manufacturing primary aluminum via electrolysis.
Recycling aluminum from packaging can be done in one of two ways depending on the ratio of residual organic matter after use. Hence recycling so-called solid aluminum packaging (drinks boxes, food boxes and spray cans) is different from recycling flexible aluminum packaging (containers, single-layer or multi-layer tubes, multi-layer tubes mostly made of aluminum).
Compacted solid packaging can be melted directly in a rotating oven with a temperature higher than the fusion temperature of aluminum. Both humidity and organic matter percentage must be lower than 5%.
Flexible packaging with a high organic matter percentage (due to the presence of a layer of polymer or paper) must be submitted to pyrolysis. The ensuing depolymerization of organic products (polymers and varnish) creates volatile organic molecules in a poorly oxygenized atmosphere. The molecules are then used as fuel to generate the energy necessary for their own depolymerization. This technique is a way of "freeing" aluminum from its organic layer, enabling it to serve as a raw material in the smelting of the second fusion.

Circular economy and mutualized action

6. The creation of Eco-Emballages as a reaction to the EPR regulation

In the span of **20 years**, Eco-Emballages developed an original **model** aimed at global interests and with a non-profit objective. Eco-Emballages combines **the development of an efficient economic system with the ecological commitment that was its creating factor**.

- As a leader in the sorting and recycling of domestic packaging, Eco-Emballages' action is part of the **circular economy model logic**: the company's goal is to improve the recycling rate so as to minimize the consumption of natural resources.
    - In accordance with this line of thought, it promotes **innovation** and **achievement**: it informs and brings its expertise on recycling to the companies concerned, supports the development and implementation of **eco-design**, an essential part of recycling, but also supports the development of new recycling techniques, especially for plastics.
    - Eco-Emballages is in charge of **EPR** (Extended Producer Responsibility) and is responsible for the efficient management of recycling by packaging manufacturers. It also ensures the **financing** of this recycling in collectivities via an incentive grading scale provided by the Green Dot. These collectivities' achievements are in turn financially prioritized.

It falls in line with an **ecological reasoning**, promoting source reduction in packaging and emphasizing positive actions by using an **incentive grading scale** provided by the Green Dot (covering the environmental cost of packaging and prioritizing their reusability).

- Beyond the ensuing positive environmental impact, Eco-Emballages' model has **generated value and employment in France** - recycling is, today more than ever, a **promising industr**y. This model echoes Michael Porter's idea of "**shared value**"[39]:
    - For 20 years, Eco-Emballages has supported the constitution of **a new business field**, with a positive impact on territories. A new industry was thus created, and the market for recycled material is expanding.
    - **28,000 jobs** were created.
    - This business brings together a **chain of players** united around one cause, from collecting to recycling: collectors, waste center personnel, waste sorting agents, industrial personnel for collecting and recycling.
- Lastly, this economic model is also unique in the variety and importance of the **stakeholders** involved, still according to Mr. Porter's ideas:
    - The State determines the objectives and monitors the operations;
    - The companies have pooled their actions and finance the organization;
    - The product-manufacturing companies and the packaging companies take part in eco-design best practices;
    - Territorial collectivities collect and sort the waste;
    - Final recyclers transform matter and reinject it into a now circular economy;
    - The consumer is at the heart of the system with the sorting gesture.

[39] "Creating Shared Value: Redefining Capitalism and the Role of the Corporation in Society" - Michael Porter.

7. Methodological guide for Eco-design of the CNE

Created in 1997, the CNE brings together all of the members of the packaging chain to elaborate and broadcast the best practices for designing, marketing and using product packaging.
In 2000, the CNE published a handbook for "*implementing prevention when designing and manufacturing packaging*". In 2012, the CNE, together with economic stakeholders and organizations involved in the packaging value chain, wrote a document entitled "*Eco-Design and Packaging: Methodological guide*". This publication, a supporting document for companies, is a reminder that eco-design must become a part of the packaged product's whole life cycle; it is a functional approach which leads to thinking on the product itself as well as the features of the packaging. This methodological guide to eco-design was completed in 2013 by an editing guide to environmental claims regarding packaging.

8. Prevention cases of the CNE/Eco-Emballages

The CNE has been monitoring the prevention efforts of its partners since 1998[40] and documenting via a previous critical review the cases of prevention by source reduction it has been made aware of, if the frame of reference for theses prevention efforts is compliant with the EN 13428 standard.
In 2011, the CNE updated its reference frame to introduce new key indicators of prevention[41]. It allows each company to measure its continuous improvement in the prevention of environmental impacts, according to four key indicators depending on the perimeter one wishes to examine.
This reference frame is an application of an analysis method and measures impacts according to the following principles:

- Product/packaging combination
- Identical use value for the consumer
- Balance of the complete packaging system (primary, secondary, tertiary)
- Volume indicators (ratio of content/container and palletizing ratio)
- Amount of recycled matter

This helps to lend credibility to prevention by leaning on tangible realizations that can be used as models. It also leads to the opening of an objective debate on the topic of prevention and of how to promote its development, involving all of the players in the packaging chain.
Since 2013, the economic stakeholders' initiatives in terms of packaging waste prevention and of eco-design alike have been collected by the CNE or Eco-Emballages. These initiatives can be seen on the websites of both organizations.

Eco-Emballages has been publishing since 2012 prevention cases established according to the CNE's principles.

Through this initiative, Eco-Emballages has developed a dedicated website, allowing companies to declare their own actions in favor of packaging source reduction. This website can be accessed through the following pages: http://reduction.ecoemballages.fr and http://reduction-emballages.adelphe.fr. It is linked with an online catalogue of the best practices, to broadcast the positive actions of companies wishing to communicate on these actions, thus encouraging all member companies to reduce packaging at source.
This website lists over 160 cases of prevention:

- It is a way for companies to display their actions in favor of reducing the environmental impact of their packaging. It shows these actions through photographs and simple explanations.
- It is freely accessible and can be seen by companies, consumers…
- It can be monitored and used to generate ideas for companies.

[40] Catalogue for the prevention of packaging waste, 1998, CNE.
[41] Key indicators of prevention: http://www.conseil-emballage.org/wp-content/uploads/2014/01/63_0.pdf

Conclusion

The Circular economy model has now become a **reality** in the world of packaging, and the following **best practices** are an illustration and reminder of this.

1. Packaging **eco-design** places great emphasis on environmental awareness and, more generally, sustainable development.

2. **Reuse** is the process implemented when it is economically and environmentally viable.

3. **Source reduction** has for decades been allowing the sector to profit from technological progress and constantly decrease the use of materials.

4. Used packaging is largely **recycled** and the recovered materials are used in "packaging" loops, or larger loops aimed at other uses.

5. Non-recycled packaging is recovered and used for energy with a clear objective of zero waste in landfill.

6. Another avowed objective of the « packaging » value chain is the decrease in use of **non-renewable resources**.

7. All of this activity is intimately linked with the materials and packaging needs **across the whole country**, with a constant objective of decreasing transport.

8. The packaging value chain is **proactive** so that all of the economic stakeholders may profit from each other's progress.

Lastly, it must be remembered that this **dynamic of success** was only possible thanks to the **constant rallying of all parties involved** – citizens, territorial collectivities, authorities, organizations, companies – as the saying goes, you can go faster alone but you can go further together!

This renewed commitment from the complete packaging value chain is a sign that we can still progress.

Appendices

A few supplementary definitions

- **Constituent**: the constituent of packaging is an element, which cannot be easily separated from the rest of packaging, such as glues, inks and sealing wax.
- **Component**: the component of packaging is an element, which can be easily separated from the rest of packaging by hand or by simple physical operations (see standard EN 13427).
- **Overall packaging system**: it is made of primary, secondary and tertiary packaging, including upstream packaging (used for transporting, protecting and packaging raw materials / packaging aiming to produce the product).
- **Functional unit**: it is the reporting unit in the Life Cycle Assessment (LCA). It is used to indicate the impacts on a representative and adequately characterized element such as the product-packaging combination, or the product or packaging alone.

Packaging functionalities

Non-exhaustive list with a few examples:

- **Preserving and protecting the product**

It must protect:

- The environment from the product inside (limiting potential leaks, stopping solvent evaporation to protect the user's health and banning dangerous uses for children, etc.)
- The content from external constraints (limiting damage incurred by mechanical impacts, reducing the effect on taste and odors, preserving from air or oxygen spoiling, protecting from germs, insects or undesirable products interference, preventing theft or consumption of the contents before purchase, increasing the lifecycle of perishable goods...).

- **Informing**

- Providing general and legal information (use-by date, storage temperature, user's guide, posology/unit dose, composition, presence of allergens, price, quantity, weight, etc.)
- Providing information on the conditions of the production process (Eco-label, "Label rouge" – a French national quality assurance scheme for food products managed by the Ministry of Agriculture, fair trade, AOC label, etc.)
- Providing information related to the characteristics of the product in its market environment (brand, allegations about nutrition and/or health, recipes, cooking mode, product history…).

- **Grouping consumption units**

- Grouping several consumption units together so as to get an adequacy between the products consumption and the frequency of the purchase (yogurts or beer packs)
- Gathering products in easily manipulable units (packs of biscuits) to ensure different types of consumption (nomadic lifestyle…)
- Promoting products (promotional kit)
- Facilitating handling and transport for the consumer
- Making shelves stocking easier as well as any other handling actions for operators.

- **Transporting and storing**

- Delivering the goods from the production site to the sales area without any damage (protecting the product-packaging combination from mechanical accidents) by wooden pallets, corrugated cardboard protections, corner protections, metallic and plastic strings, stretch and shrink-wrapping, etc.
- Protecting against any malevolent act (theft or "bioterrorism")
- Notifying logistics centers of the contents of transport crates (logo, brand, contents, bar-code etc.)
- Facilitating their storage by the consumer
- Ensuring that the consumer may easily transport the products home

- **Facilitating the use of the product**

- The use of the product and its packaging go hand in hand, since they are often inseparable:
- Easy opening of the packaging for groups of consumers (seniors, children, nomadic adolescents, athletes, etc.)
- A closing mechanism to enable later consumption of the product
- Multi-portions for a split consumption or an on-the-go consumption
- Comfortable handling of the product to ensure optimal matching between weight, size, form and frequency of use
- Exact doses to limit losses
- Restitution of the product: emptying as much as possible the contents out of the packaging
- Using the product-packaging combination for any kind of preservation (freezing) or of preparation (oven, microwave, double boiler, etc.)

- **Facilitating the packaging of the product**

- Fulfilling automated systems without inadvertent shutdown
- Guaranteeing the safety of the employees in charge of packaging operations
- Carrying out packaging operations at reasonable costs
- Resistance to all packaging operations (impacts, heat, output, vibrations, closing, hygiene, canning…)

- **Making the product visible and spreading the values of the product and/or of the brand, of the company**

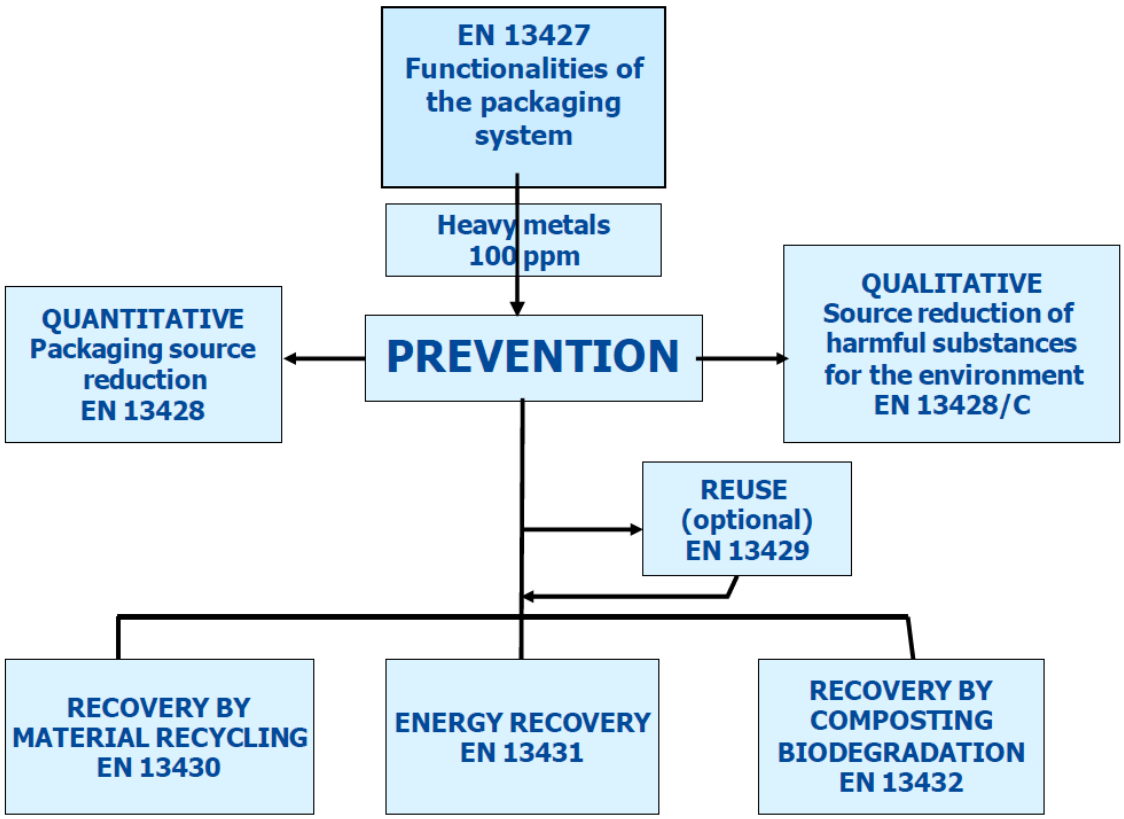
- Encouraging the act of purchase through packaging, which constitutes a beacon among the shelves (the consumer only spends a few seconds in the aisle) thanks to a color code (green for bifidus yogurts, red for cola beverages…), the shape of the packaged product (orange-shaped bottle for orange juice), the material used and the context to be referred to (wood for tradition), graphic design and typography for immediate product recognition
- Spreading the benefits and values of the brand and the company (corporate social responsibility)
- Guaranteeing acceptability for the consumer during the purchasing and consumption phases of a product[42].

[42] Acceptability of packaging for the product, the consumer and the user, CNE, October 2010.

Standards of compliance with the essential requirements of European Directive 94/62/EC regarding packaging

The presumption of conformity of packaging to the essential requirements of European Directive 94/62/EC can be established through a series of standards set up by the European Committee for Standardizations and published in the Official Journal of the European Union on February 19th, 2005.
Standard NF EN 13427 "Functionalities of the packaging system" specifies the procedure of standard use for the implementation of technical documentation.
Prevention by source reduction is dealt with in Standard NF EN 13428.
Packaging recovery is monitored according to standard NF EN 13430/13431/13432.

The following diagram is a good example of the rules applicable to packaging and packaged products:



Standards for Life Cycle Assessment

Life cycle assessment is an environmental assessment tool with several criteria regarding the entire life cycle of a product. A series of **ISO 14040** standards have been issued for the methodology of this analysis

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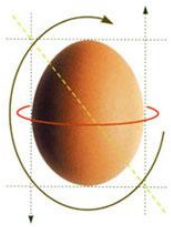
The CNE's nine colleges

Packaging materials manufacturers
Packaging manufacturers
Consumer goods companies
Retail companies
Companies authorized by the public authorities to organize the collection and recovery of packaging waste and operators in this sector
Consumer associations
Environmental protection organizations
Local authorities
Other federations and companies



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