

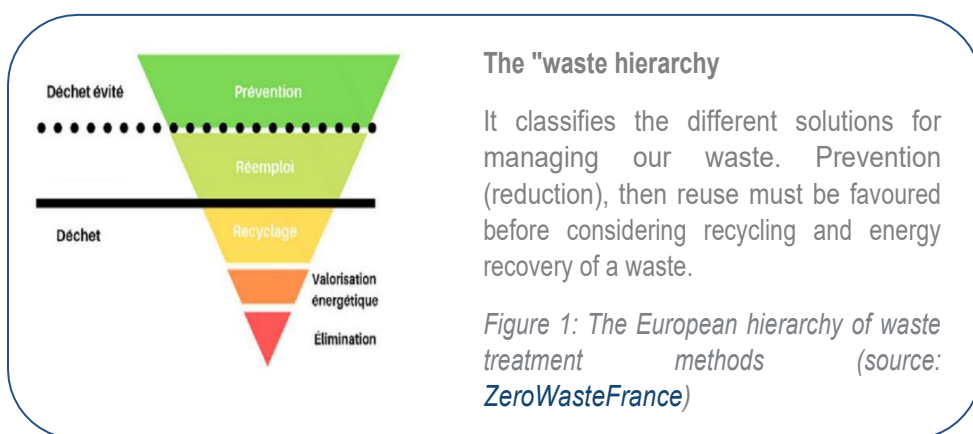
A look at recycling

Thematic Session #1 & #2 - Fact Sheet

This fact sheet is based on the **contents of the two thematic sessions on recycling** and some additional research. The session of 15 April 2021 invited Mokhtar Zannad (Nielsen Recycling) and Nathalie Gontard (INRAE) to speak, and the one of 10 June 2021 Sophie Genier (Citeo), Christine Leuthy-Molina (Citeo) and Nicolas Pont (Veolia).

RECYCLING AND CIRCULAR ECONOMY LOOPS

The principle of the circular economy is to **achieve closed loops of material and energy**: waste is regenerated over and over again to make it a resource and avoid its accumulation. As plastic has an extremely long lifespan, its waste does not decompose and accumulate, its carbon does not return to the natural biological cycle. Recycling, while far from being the universal solution to the plastic problem, aims to get closer to these biological loops, by creating an infinite number of closed plastic loops. Obviously, the first step in addressing the plastic waste problem is to reduce our consumption, and to develop materials that have a zero "macro-micro-nano" plastic footprint.



Beware of false friends!

"We should not confuse decycling with recycling! Today, most of what we call plastic recycling is actually decycling."

Nathalie Gontard

RECYCLING DEFINITION LANDSCAPE

There is no standard definition of recycling today. The definitions of the four speakers were therefore collected in order to create an overview of the definitions used during this 'Recycling' cycle and to illustrate this diversity:



Nathalie Gontard, INRAE

"Recycling means **any recovery operation, indefinitely repeatable**, by which waste materials are regenerated into materials technically indistinguishable from virgin material."

"Decycling means a recovery operation that can be repeated several times, whereby waste materials are converted back into materials of lower quality or value than the virgin material, to make a different object with a different use than the original plastic. Decycling requires finding new outlets for plastic and encourages its consumption."



Mokhtar Zannad, Nielsen Recycling

"Recycling is an industry where **waste and scrap materials, often available locally, are used to produce new products.**"

It is a way of reconciling two ecological and economic aspects while saving natural resources, energy and creating wealth and employment."



Sophie Génier, Citeo

Recycling: "The process of **transforming materials from waste into new materials that re-enter a production cycle**, replacing all or part of a virgin raw material.



Nicolas Pont, Veolia

Recycling Recyclability: "**The potential for recycling.**
Recyclability: "Potential for recycling."

NATIONAL AND INTERNATIONAL CONTEXT

While the EU target is to reach 55% recycling of plastic packaging by 2030, current recycling rates are lower overall and vary widely between countries. In 2018, the EU average is 41.4%: Lithuania is the most advanced country (63.3%) while Malta is at the bottom of the ranking (11.1%) (source: [All Europe](#)). This can be explained by **different strategic choices** for waste management. For example, Scandinavian countries have favoured incineration for their plastic waste, while other European countries have relied more on recycling. In France, the emphasis was first placed on energy recovery, and is now moving towards more recycling and energy recovery.

The **plastic recycling rate in France is around 26%**. For plastic packaging, it is 28% in 2020, an average that hides disparities: 54.5% of bottles and flasks are recycled, while the rate is 7.5% for all other plastic packaging (source: [Citeo](#)). These rates **vary locally** depending on collection rates. The extension of sorting instructions (ECT) throughout France by 2025 should theoretically improve the situation.

Prices in the plastic recycling markets **are heavily influenced by oil prices** and other global factors. When China closed its borders to recycling materials in 2018, this led to a 50% drop in recycling capacity for European tonnes of waste and consequently a drop in market prices for recycling materials.

Furthermore, in Europe, there is a lack of recycling infrastructure. In France, **waste treatment prices will rise from 50€/t in 2005 to more than 200€/t in 2025** (including Tgap) (closure of landfills, increase in taxation etc.). We will have to sort and recycle more to absorb this increase in costs.

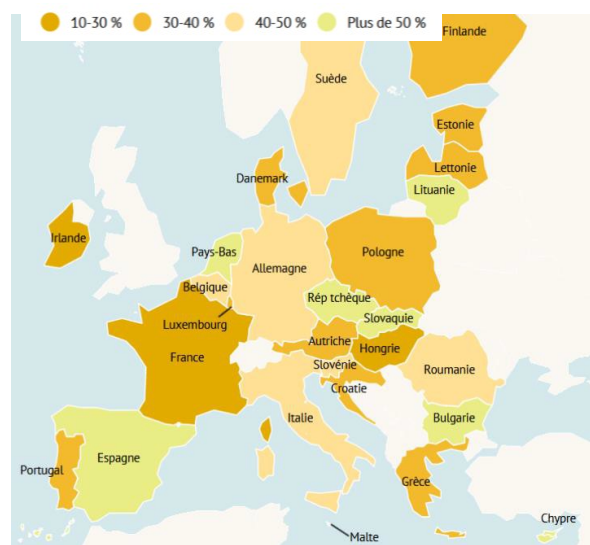


Figure 2: Recycling rates of plastic packaging in Europe in 2019 (source: [AllEurope](#))



Focus on Tunisia

With 340,000 t of plastic consumed per year, it is the leading consumer in Africa and the 4th in the Mediterranean. Although the national recycling rate is only 4% (all plastics combined), the collection and recovery rate (flakes or granules) is much higher. It reaches 26% for PET for example (source: Nielsen Recycling).

The informal sector plays a key role in waste management. PET is the best recycled plastic. Berbechas collect and sort between 60 and 80% of the PET collected in the country, which they then take to voluntary drop-off points in the Ecolef network managed in collaboration with ANGED. The bottles are then mechanically recycled to make rPET, for which there is a growing demand.

To enable the sector to develop, two obstacles still need to be removed: upstream, improving supply, and downstream, authorising the use of recycled plastic for food contact.

THE DIFFERENT TYPES OF RECYCLING

"We have created a very complex plastics landscape so it is only natural that we have an equally complex recycling landscape! (Nathalie Gontard). There are thus different types or methods of recycling, with each plastic having its own recycling method or methods.

As regards the multiplication of recycling channels, given the quantity of plastic consumed and the delay we have, **all avenues seem to be good to take**, provided that their feasibility and profitability are analysed. For example, it would be important to further investigate the energy balance and economic issues related to chemical recycling.

Two main categories are distinguished:

- **mechanical recycling** where the material is washed, ground and extruded. The general molecular structure of the polymer chains is not changed. This type of recycling has proven to be successful, particularly for polyethylene (PET).
- **chemical recycling** where the material returns to a lower level in the molecular structure of the plastic: to the polymer, monomer or even the raw material. Chemical recycling is under development. It is not a miracle solution, it is impossible to use a mixture of unsorted and unprepared plastics as an input and obtain a 'magic' oil with which everything is possible.

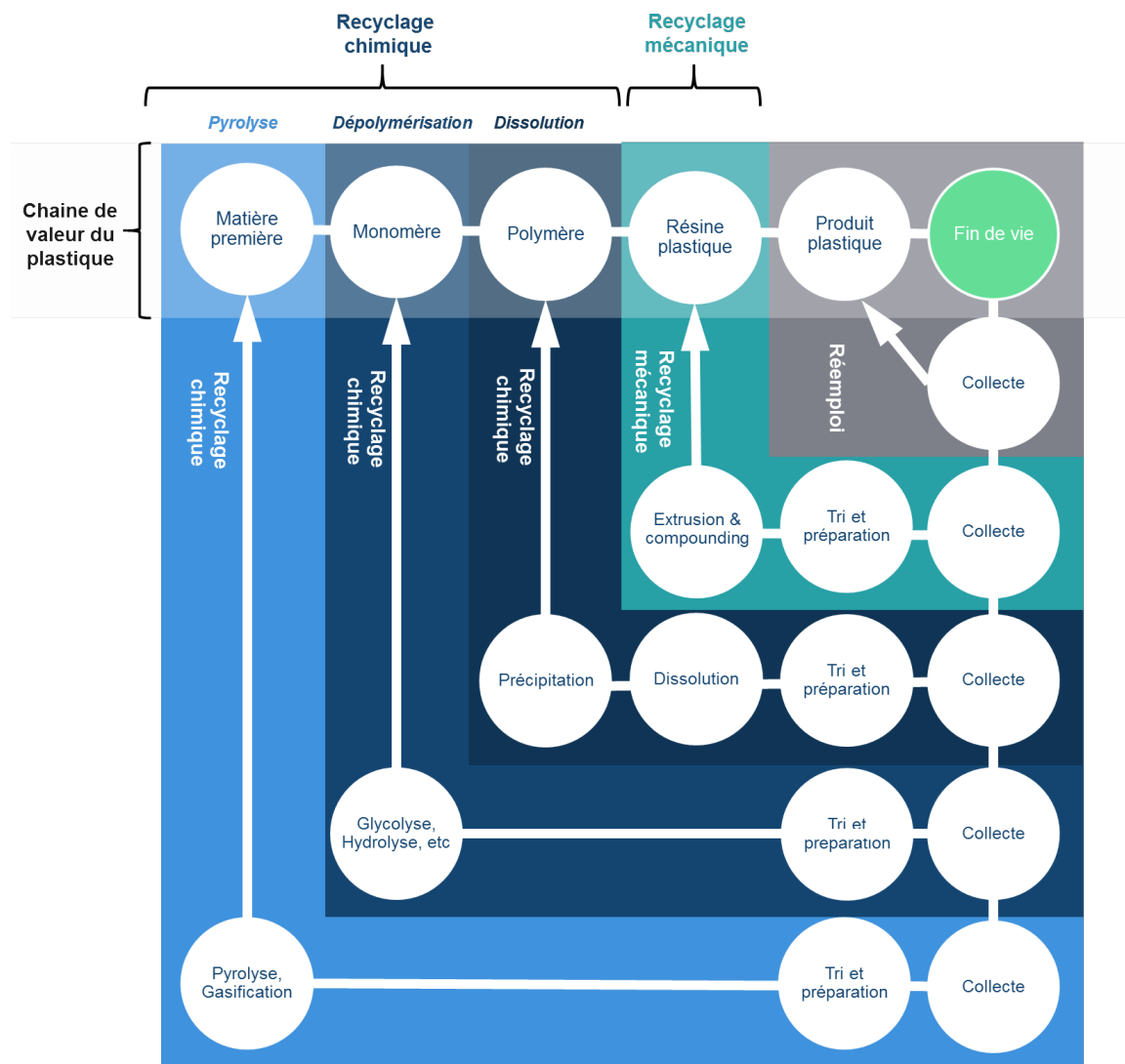


Figure 3: The different recycling loops (source: ConsultantSeas based on the conference "Plastic recycling: The 4 keys to success", 2021, Suez)

COMPARISON OF MECHANICAL AND CHEMICAL RECYCLING



	 Benefits	 Disadvantages
Mechanical recycling	<ul style="list-style-type: none"> - proven and optimised method in terms of yields (60-80%) and costs - existing opportunities - a positive environmental record 	<ul style="list-style-type: none"> - requires homogeneous and clean waste - does not remove colour and mineral fillers - return to food use only possible on PET - limited number of cycles as the material is degraded each time
Chemical recycling	<ul style="list-style-type: none"> - possibility of recycling certain complex packaging - possibility of returning to foodgrade - better quality of the recycled material (especially for the depolymerisation/pyrolysis process) 	<ul style="list-style-type: none"> - still a very emerging technology (no visibility on costs; no widespread industrial application) - issues still outstanding (yields, environmental sustainability) - requires high quality inputs (more material preparation)

Table 1: Summary of the advantages and disadvantages of mechanical and chemical recycling today (sources: Citeo, Veolia)

Chemical recycling is not a miracle solution! Contrary to many preconceived ideas, it will not be possible to recycle all complexes, or to use a mixture of unsorted and unprepared plastics as input. It is therefore essential to maintain the objective of simplifying structures and to aim for a single material.

RECYCLING IS ALSO ABOUT 'COLLECTABILITY' AND 'SORTABILITY OF THE PLASTIC DEPOSIT

In order for a product or packaging to be recycled, it must first be **collected**, and therefore the appropriate collection route must exist. Once collected, the waste must be **sorted** in a sorting centre and then directed to the right recycling channel. For example, it must be large enough or detectable by machines.

Improve eco-design, collection and sorting to improve recycling

- The **extension of sorting instructions** to all plastic packaging, which is gradually being introduced in France, together with an increase in the consumer's **sorting behaviour**, would make it possible to improve the collection of plastics
- **The eco-design of packaging** to create collectable and sortable products and the **modernisation** of sorting centres would improve the sorting of plastics and their orientation towards the right recycling channels for the material.

ASSESSMENT OF RESINS CURRENTLY RECYCLED IN FRANCE

Resins currently recycled (household waste stream)	Resins currently recycled (industrial waste stream, therefore not recycled for household waste)	Resins not currently recycled
Rigid PP Rigid PE Rigid PET (bottles and flasks, single layer trays without lids) Flexible PE	Flexible PP Rigid PS Rigid PSE PET Rigid Lidded PLA Rigid Rigid PVC Rigid ABS, PA6.6, PA11, PA12, PMMA, PC...	Flexible PET Rigid XPS Rigid PET PET/PE Flexible PLA, PHA, PHB ... Rigid PEF, PBS

Table 2: Summary of recycled resins in France today (source: Nicolas Pont, Veolia)

BARRIERS TO THE INCORPORATION OF RECYCLED RESINS

Today, the **rate of incorporation of recycled plastic is 6.5% in France**. This incorporation rate is very low because recycling companies have difficulty finding outlets for this raw material, even though the qualities (apart from colour) may be comparable to those of virgin material.

Virgin plastic is cheaper than recycled plastic because **its price does not reflect its real cost** (e.g. end of life, ecological impacts, etc.). Regulation or taxation of virgin material could be an interesting solution to encourage the use of recycled material. Such regulation will come into force in April 2022 in the UK ([link](#)), with a tax on plastics with less than 30% recycled content.

To ensure the profitability of the sectors and thus reduce the price of recycled plastic, it is necessary to stabilise the flows of incoming materials and then find outlets for the recycled material, and invest in the modernisation of sorting and recycling centres.

The blind spot for biobased and compostable plastics in this landscape

Many new resins are ready to be introduced to the market. These plastics have potential but are not suitable for all uses, so their use must be well thought out beforehand. They represent between 1 and 2% of the tons of plastics produced in the world and the management of their end of life raises new questions:

- Disruption of sorting and recycling lines if they are misrecognised and mix with existing streams.
- For compostable plastics, this designation covers a wide range of resins with very different biodegradability conditions and which require a separate biowaste collection channel (sorting at source mandatory in Europe by 2023).

The European Union is establishing a policy framework on the sourcing, labelling and use of biobased, biodegradable and compostable plastics to clarify the opportunities and risks.

For more details, the minutes of both sessions are sent by e-mail and remain available to College members on request.