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# Circularity in the Mobility universe

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# Introduction

The Circularity Gap Report annually assesses the circularity of the global economy, which refers to the proportion of resources that are reused or recycled after use. Although there is increasing discussion of a circular economy, the reality is quite different: our circularity, already low, is declining. In 2023, it stood at 7.1%, down from nearly 9% five years ago. Several planetary boundaries have already been exceeded, accompanied by a growing consumption of raw materials. It is estimated that nearly 70% of greenhouse gas emissions are linked to the extraction, transformation, and use of raw materials[1].

Mobility sector stakeholders must therefore manage to balance increasing mobility needs with a reduction in their environmental footprint, both direct (scope 1 & 2) and especially indirect (scope 3), as the sector accounts for nearly 30% of global emissions and 10% of the resources used worldwide[2].

Beyond the sustainability of their activities, the circularity of activities is crucial for the Mobility universe (and the automotive industry in particular) and could even become an economic opportunity by not only reducing costs but also reducing risks (including geopolitical risks) associated with accessing certain raw materials.

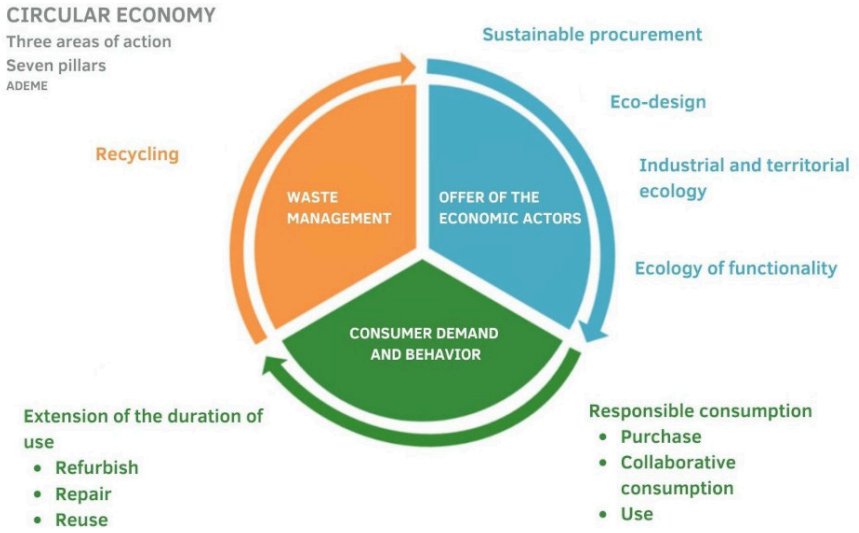
Circularity should not be limited to end-of-life recycling, but should be seen as a holistic approach that aims to replace the linear economy. This article will thus cover all the levers of circularity, including eco-design, repair, and refurbishment.

[1] Bain x Circle Economy, 2022 | Beyond recycling: the circular opportunity for passenger cars in Europe.
[2] Bain, Décembre 2022 | Reuse, Remanufacturing, Recycling, and Robocabs: Circularity in the Automotive Industry.

# What does circularity really mean?

In the mobility universe, as in other sectors, the concept of circularity goes far beyond simply recycling vehicles at the end of their life. It also encompasses the eco-design of vehicles, which integrates the use of recycled materials and the design of more compact and lighter vehicles, as well as the possibility of giving vehicles a second life through reconditioning, reuse, or functionality economy processes (i.e., renting rather than buying).

The ADEME (the public agency for the ecological transition in France) outlines these circularity challenges around the following seven pillars:




*Source - ADEME | The 7 pillars of circular economy*

Often under-recognised by the public as a lever for circularity, the circular economy has a crucial role to play. Although often under-recognised by the public as a key lever for circularity, the circular economy plays a crucial role by densifying the use of vehicles, thereby reducing the need for new resources to transport people or goods.

Circularity thus manifests itself in several key strategies, each of which plays a specific role in reducing the environmental impact of the automotive sector. As there is no single definition of circularity (a Dutch study identified 114 different definitions), we will focus on the strategies listed below, from the upstream to the downstream of the vehicle life cycle:

1. **Eco-design** aims to integrate environmental considerations from the very beginning of product design. In the Mobility universe, this notably involves reducing the overall mass of the vehicle to enhance its energy efficiency, minimizing its carbon footprint by ensuring its repairability throughout its life cycle, and choosing recycled or easily recyclable materials.

This first axis is crucial as more than half of the vehicles sold in Europe are now SUVs. Similarly, the energy efficiency of vehicles is particularly important, especially for electric vehicles where there are already significant differences between models

equipped with the same battery capacity: the Tesla Model 3 Long Range has a 78 kWh battery with an efficiency of 14 kWh/100 km, while the Mustang Mach-E consumes significantly more energy (19.6 kWh/100 km) for a slightly smaller battery (75 kWh).

Specifically for tyres, Michelin markets the eco-designed e.Primacy model, which, thanks to lower rolling resistance, could save 0.2 L / 100 km or improve the range of an electric vehicle by 7%.

Eco-design is also widely applied to micro-mobility vehicles, such as the French company Mob-ion, which markets an electric scooter designed for longevity (62% of the components, representing 78% of the initial value of the vehicle, can be recovered and reused to make a new scooter), or the Dutch company Roetz.life, which offers a fully modular and recyclable electric bicycle.

2. **Repair** is essential to extend the life of vehicles and minimize waste. It allows vehicles to remain in circulation longer, thus reducing the need to produce new vehicles and consume new resources. The average age of cars in the EU is currently 12.3 years, with significant differences between countries: vehicles in Greece and Estonia have an average age of 17 years, compared to less than 9 years in Denmark or Austria.

Promoting the repairability of vehicles is therefore a key pillar in promoting a more circular economy in the sector, although many challenges remain to ensure this. The HOP (stop planned obsolescence) association has published a report warning of the risk of obsolescence of electric vehicles due to difficulties in easy battery repair and the use of giga-casting, a practice where entire body parts are offered in a single block.

Our parent company Mobivia is leading several initiatives to improve repairability, such as the partnership between Norauto France and Cotrolia for the repair of automotive electronic parts (ABS block, engine control unit, car radio, dashboard, etc.).

3. **Reuse** involves the reutilization of a vehicle or its components for the same use. This concerns the sale of used vehicles but also the use of spare parts from end-of-life vehicles (ELVs) to repair other vehicles.

Reuse is particularly relevant in the event of car accidents, when only certain vehicle components need to be replaced. In this context, insurers are essential prescribers in favor of generalizing the use of reused parts: to this end, the insurer Matmut has signed a partnership with Valused, a specialized marketplace for used parts, with the objective of using such parts in at least 20% of car claims by the end of 2024.

4. **Remanufacturing**[3] goes beyond reuse by restoring a vehicle or its components to a state close to new. This can include technological updates, replacing worn parts, and improvements to meet current safety or environmental standards.

The sector of refurbished electric bicycles is particularly dynamic, illustrated by French companies such as Rutile.bike, Loewi or Upway.

[3] For the sake of simplicity, we are including the concept of reconditioning in remanufacturing, the latter being the most complete operation (restoration to a condition with characteristics similar or even close to new).

In the automotive world, Mobivia (parent company of Via ID), through its Iwip business unit, is particularly involved in circulatory issues, with a particular focus on batteries, used oils and tyres. The commitment is particularly strong in the latter universe, with the Léonard remanufactured tyre allowing savings of 80% in materials and 63% in CO2 during its production.

5. **Recycling** is the last resort in a circular scheme, transforming used materials from end-of-life vehicles into new usable materials. This reduces dependence on virgin resources and minimizes the environmental impact associated with the extraction and transformation of these new resources.

The automotive sector is not the only one in the mobility sector to be working towards greater circularity and, in particular, better product recycling. Schwalbe, in the bicycle sector, has been working since 2015 to make the recycling of used inner tubes and tyres systematic, so that the recycled raw materials can be reused in new products.

## Circularity in the mobility universe: why is it becoming essential?

- **A regulatory framework that favors better circularity**

Europe is at the forefront of the circular economy challenge, exemplified by the European Directive 2000/53/EC on end-of-life vehicles (ELVs), which generate 9 million tonnes of waste in Europe each year. This directive requires new vehicles to be reusable and/or recyclable to a minimum of 85% of their weight per vehicle (and 95% reusable/recoverable).

The European Union has reinforced this regulatory framework with the launch of its Circular Economy Action Plan (CEAP) in 2015, which aims to reduce the linearity of its economy as much as possible. This plan included 54 actions, all of which were adopted or implemented as part of the Green Deal, with targets for the reuse and recycling of materials by 2030 or 2035.

In addition, the European Commission is currently working on a new proposal for a regulation on end-of-life vehicles, which will include new obligations for the recovery of parts and components before vehicles are shredded:

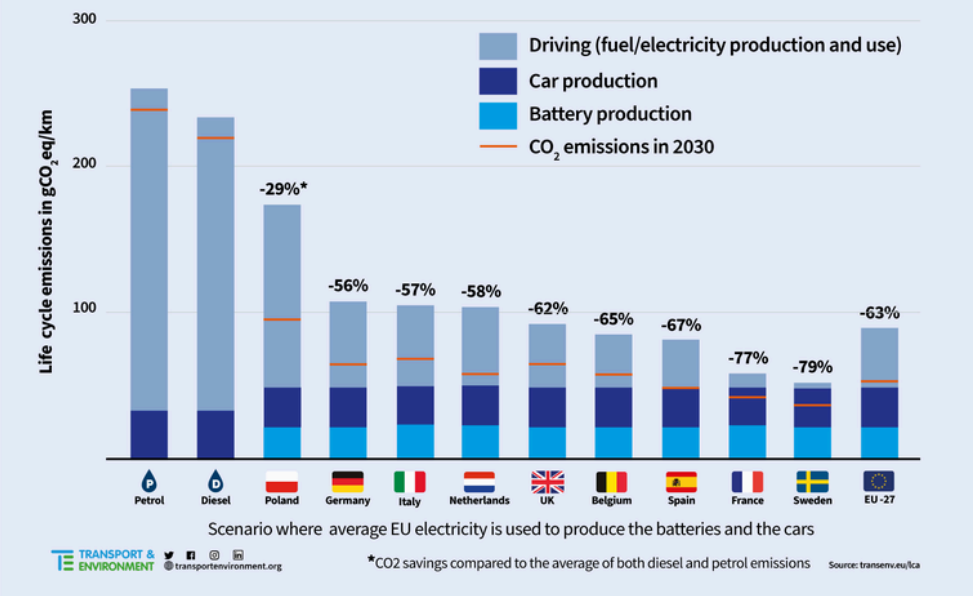
- An improvement in the circular design of vehicles to facilitate the removal of materials, parts and components for reuse and recycling;
- A guarantee that at least 25% of the plastic used in the manufacture of a vehicle comes from recycled sources (including 25% from recycled end-of-life vehicles);
- An increase in the recovery of higher value raw materials, including plastics, steel and aluminum;

- An extension of the obligations to other vehicle categories such as motorcycles, trucks and buses.

According to the European Commission, this proposal should lead to an annual reduction of 12.3 million tonnes of CO2 and better valorisation of 5.4 million tonnes of materials by 2035.

- **Car electrification makes circularity even more important**

While it is clear that electric vehicles (EVs) can significantly reduce greenhouse gas emissions over their entire life cycle, regardless of the energy source used in Europe, their production is still more polluting than their thermal equivalents: 50 to 60% of the emissions from electric cars are related to their production, compared to around 10% for their thermal equivalents.




*Source - Transport & Environment | Comparison of CO2 emissions between ICE and EV in Europe*

Therefore, the full circularity of the vehicle, from its design, becomes relevant to accelerate the benefits of the electric vehicle compared to a thermal model. Research by Aurélien Bigo, a French specialist in the energy transition of transport, also shows that the switch to electric propulsion is not enough and that the market needs to move towards greater moderation with smaller vehicles. This approach is crucial to reducing the overall environmental impact of the mobility sector, making circularity not only beneficial but essential.

# Circularity in the mobility universe: Where are we in Europe?

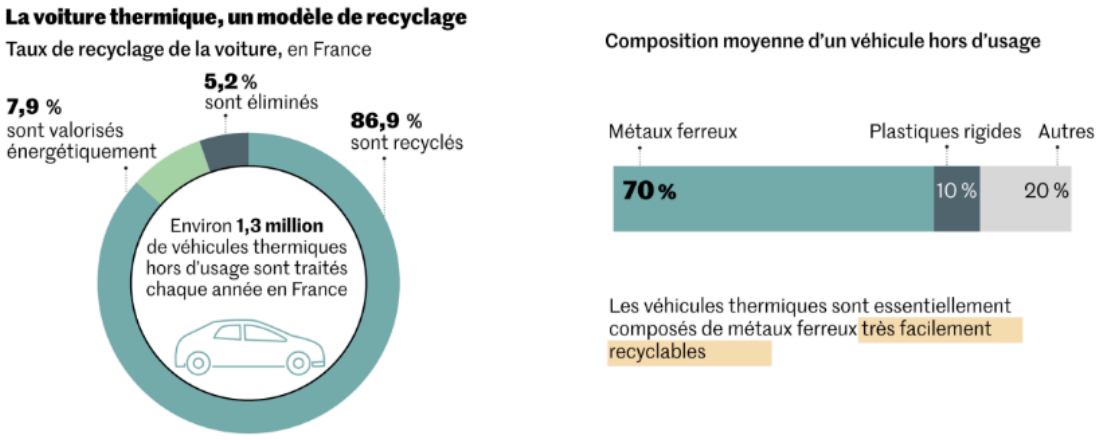
- **Carmakers have made global progress in almost 20 years**

Vehicle manufacturing has become much more complex over the last two decades, with cars now equipped with additional devices to make them safer, more efficient and smarter. This increased complexity naturally requires more energy in vehicle design. In response, carmakers are improving the energy efficiency of their production chains. This has led to a global reduction in the resources needed to produce European vehicles between 2005 and 2022: -5.7% in energy consumption per vehicle, -34.4% in water consumption and -7.4% in associated CO2 emissions. Unfortunately, these savings are largely offset by the production of increasingly popular SUVs.

- **A still uneven situation in Europe**

In 2023, the consulting firm Bain published a report entitled *Reuse, Remanufacturing, Recycling, and Robocabs: Circularity in the Automotive Industry*, which looks at circularity initiatives in the European automotive industry.

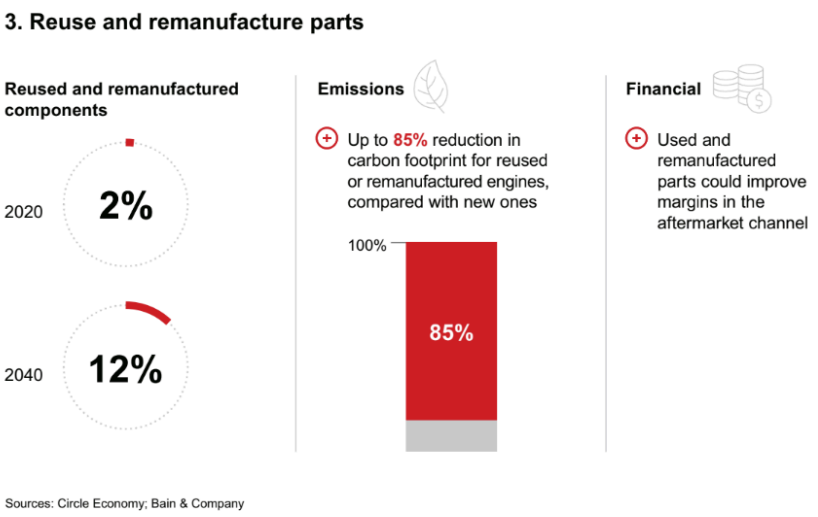
This report claims a recycling rate of 89% of materials from end-of-life vehicles, mainly aluminum and steel. However, this figure does not take into account losses and inefficiencies in recycling processes, nor does it take into account end-of-life vehicles exported from Europe to emerging markets. The recyclability rate then falls to 78% and 59% respectively. Bain estimates that the 78% rate could reach 97% by 2040.




*Source - Le Monde | Comparison of CO2 emissions between ICE and EV in Europe*

Recycling of the high-value materials that make up the battery is still limited, but will be the subject of a forthcoming article specifically on the circularity of electric batteries.

Another important lever for circularity is the repair of vehicles, whether as a result of an accident or simply as part of vehicle maintenance. In 2020, only 2% of European spare parts will be recycled (see the Bain x Circle Economy graph below).




However, the complete reconditioning of a vehicle appears to be the most powerful lever for circularity, since it requires only 15% of the emissions required for the production of a new vehicle.

The European auto parts refurbishment market is dominated by Germany, the UK, Italy and France, which collectively account for over 80% of market share. Germany has the largest number of motor vehicles on the road, giving it the greatest potential for refurbishment. It is also a major automotive production base, with manufacturers such as Volkswagen, Daimler and BMW. The UK is the second largest market, thanks to the strength of the automotive aftermarket industry.

# Circularity in the mobility universe: current and medium-term perspectives

- **Long-term commitments from car manufacturers**

European automakers currently use about 23% recycled materials in the production of new vehicles, a share that Bain estimates could reach 59% by 2040. The primary motivation is environmental, with a 60% reduction in emissions for a recycled part compared to its virgin equivalent. This approach also helps to combat the volatility of global prices and secure supply chains, which are still highly concentrated, particularly for batteries (e.g. cobalt in the DRC, lithium in Chile and Australia).

This target seems realistic given the ambitions of various manufacturers:

- Mercedes-Benz is aiming for 40% recycled raw materials by 2030, with a strong focus on aluminum;

- Volvo is aiming for full circularity by 2040, with a milestone of 99% waste recycling in 2030, a 50% reduction in water used in production and 35% recycled content in new vehicles;

- Volkswagen's long-term goal is to recycle 97% of lithium battery components.

However, circularity must involve the entire value chain, not just car manufacturers. They need to engage their suppliers in a virtuous circle, not just to minimize their indirect Scope 3 emissions. Several initiatives are already underway, such as the partnership between Forvia (formerly Faurecia) and Veolia to produce 30% of their interior modules (side panels, door panels, center consoles) from recycled plastic by 2025.

- **A holistic approach to circularity in the activities of car manufacturers: focus on Renault and Stellantis**

Renault, one of the more ambitious automakers, established a holding company called "The Future is Neutral" in 2022 to focus on its circularity initiatives, with Suez acquiring a 20% stake in October 2024. The Future is Neutral covers several key areas:

- Sourcing of recycled materials (Gaia)

- Reuse of scrap in vehicle production (Boone Comenor Metalimpex)

- Repair and refurbishment of parts (The Remakers)

- Recycling of batteries and complete vehicles (Indra)

By 2030, the holding company aims to triple its turnover to around €2.3 billion and achieve a profit margin of over 10%.

Another example of strong ambitions to integrate circular economy activities is Stellantis, articulated in its strategic plan 'Dare Forward 2030'. This plan aims to generate nearly €2 billion in revenue by 2030 from its circular economy initiatives, exemplified by its recycling joint venture Galloo and its used parts platform B-parts.

## Our beliefs for greater circularity in the mobility universe

- The need for global exploitation of data across the automotive value chain is critical. The difficulty of collecting, managing and analyzing data related to circularity is one of the main challenges identified.

Capgemini's study *Sustainability in Automotive from ambition to action* shows that only 12% of automotive executives say their organization has widely deployed a platform to measure, monitor and report on sustainable development initiatives.

- Circularity of resources is essential, but so is intensifying the use and maximizing the value of existing assets, moving away from an approach focused solely on ownership.
- The challenge of circularity involves many stakeholders and therefore needs to be considered beyond the scope of car manufacturers.
- Fiscal measures could also encourage the most virtuous consumption patterns, such as the introduction of reduced VAT or the exemption of eco-taxes for circular economy products/services.
- An eco-score could be considered at the design stage and not just through the prism of recycling.

In this context, the Transport & Environment think tank proposes the introduction of a specific European eco-score for electric vehicles. This tool would combine both energy efficiency (measured in kWh/km) and the carbon footprint at the production stage of the vehicle from battery, steel and aluminum (in kg CO2e).

# Conclusion

Significant efforts are still needed to increase the circularity of the mobility universe, especially in the automotive sector (even though it is one of the most circular sectors today). On an international scale, the volume of new vehicle production is twice that of parts production for repair, with 20.4 million tonnes compared to 8.7 million tonnes[4]. This disparity highlights the urgent need to improve durability and reduce waste in the automotive production chain.

According to Capgemini, achieving automakers' sustainability goals will require a massive investment of $50 billion over the next five years, in addition to specific investments in the development of electric vehicles[5]. These funds are needed not only to improve current production processes, but also to support initiatives to increase energy efficiency, reduce CO2 emissions and promote recycling and reuse of materials.

In addition to these investments, it is crucial to focus on the development of electric vehicles (EVs), which are an important part of the transition to more sustainable mobility. EVs require innovation in battery technology, charging infrastructure and environmentally friendly production methods. This includes rethinking the upstream design of batteries (eco-design, robustness), their repairability, reuse, end-of-life and ultimately their recycling.

[4] Bain x Circle Economy, 2022 | Beyond recycling: the circular opportunity for passenger cars in Europe.
[5] Capgemini, 2022 | Sustainability in Automotive from ambition to action.

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