CIRCULAR ALUMINIUM ACTION PLAN

A STRATEGY FOR ACHIEVING ALUMINIUM'S FULL POTENTIAL FOR CIRCULAR ECONOMY BY 2030

EUROPEAN ALUMINIUM

Note from the authors

This report has been drafted and coordinated by European Aluminium. Several departments were involved, including recycling, public affairs, innovation, statistics, and market groups for the main applications. All data, estimates and projections are the property of European Aluminium. All policy recommendations are those of European Aluminium alone.

The analysis has been developed in collaboration with Materials Economics. CRU Group was contracted exclusively to provide statistical modelling support and reliable estimates for chapters 1 and 2. Sources are provided for each chart.

Credits

European Aluminium expert members have contributed to all the sections of the report with data and expertise to ensure the most accurate insights. A steering group has been set up to provide guidance and shed light on the specifics of the aluminium industry. Their contribution has been instrumental for the realisation of the report.

European Aluminium would like to thank all contributors for their efforts, which are designed to help policy makers and other stakeholders re-think our future for a better and more sustainable society.

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INTRODUCTION

The latest scientific evidence on the health of our ecosystems has resulted in urgent calls to action being made to preserve our planet. The EU's proposed European Green Deal has established a clear vision and policy framework for how to achieve the objectives of the Paris Agreement[1], and how to decouple growth from increased pressure on natural resources and biodiversity depletion.

Aluminium is a circular material, capable of being recycled over-and-over again without losing its original properties (lightness, conductivity, formability, durability, impermeability and multiple recyclability). Its properties make it a vital resource for a climate neutral and circular economy, and the material of the future for applications in key sectors (including transport, construction, packaging, renewable energy technologies). These characteristics explain a projected 40 percent growth in demand for aluminium between 2019 and 2050.

Aluminium can play a leading role as a climate and resource frontrunner through the European Green Deal. European Aluminium's Vision 2050[2] articulates a clear outlook for the development of a decarbonised, circular and energy-efficient aluminium value chain in Europe by 2050. It presents three scenarios for primary production of aluminium to fully realise its strategic potential. This strategy for achieving aluminium's full potential for circular economy by 2030 builds on this Vision 2050 with a focus on circularity. Achieving the industry's full potential for circular economy will contribute directly to the UN's Sustainable Development Goals (UNSDGs), and in particular SDG 12 "Responsible consumption and production", one of the goals identified by the aluminium sector in its materiality assessment[3] that sector can make a vital contribution to.

Recycled aluminium already represents 36 percent of aluminium metal supply in Europe, but the real opportunities lie ahead. By the middle of this century, 50 percent of EU demand for aluminium could be supplied by recycling aluminium, if certain specific conditions are met.

The benefits of increased aluminium recycling are significant. According to our estimates, the amount of aluminium available for recycling will more than double by 2050. With a well implemented policy framework, increased recycling of aluminium could avoid up to 39 million tonnes of CO_2 emissions per year by 2050. As a consequence, the volume of imported aluminium sold in Europe would also decrease, reducing Europe's import dependence while generating €6 billion (bn) per year for the European economy.

The aluminium industry is keen to seize the opportunities presented by a doubling of available scrap and is ready to drive the changes needed so that the industry can capitalise on the increase of scrap. To make the required investments, however, a fair market is essential. Today, carbon intensive imported aluminium comes at a cost both to the environment – in terms of pollution – and to a fair aluminium market. Artificially cheap imports can render European investment in recycling uneconomic, meaning Europe misses out on the full advantages that increased recycling could bring. Addressing this challenge will require strong support from policy makers and strong collaboration along the whole recycling value chain. The Circular Economy Action Plan needs to create the right incentives to promote circular business models to take advantage of the enormous potential that lies ahead for the aluminium industry in Europe.

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[1] The United Nations Paris Agreement, December 2015 https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

[2] Vision 2050, European Aluminium's contribution to the EU mid-century low carbon roadmap, March 2019 https://european-aluminium.eu/vision-2050/

[3] European Aluminium and the Sustainable Development Goals, January 2019 https://www.european-aluminium.eu/media/2452/european-aluminium_connecting-the-sustainability-roadmap-2025-to-the-sdgs-_december_2018_final-edit5_din-final.pdf

01

THE ENVIRONMENTAL, ECONOMIC AND SOCIAL POTENTIAL OF CIRCULAR ALUMINIUM

1.1 Aluminium is a strategic material with great potential in the circular economy

Aluminium sits at the start of long value chains which generate products and materials that are essential contributors to Europe's transition to a climate-neutral and circular economy. By combining aluminium with different alloying elements, a wide range of properties can be obtained (lightness, conductivity, formability, durability, impermeability and multiple recyclability). Thanks to these unique properties, aluminium helps other sectors to achieve their own targets for CO_2 emissions reduction, in particular the transport sector.

Aluminium is a permanent material, which means that the metal we produce today does not just meet the current demand for the material in cars, packaging, buildings, and more – but over time accumulates to create a major economic resource for the future. Once aluminium has been produced it is meant to stay in use as long as possible and be recycled infinitely.

Just 20 years ago, Europe[4] used 9 million tonnes of aluminium per year, whereas today aluminium use stands at 13.5 million tonnes and is still growing. As a result, there is now almost twice as much aluminium in the economy for every European citizen than there was two decades ago (up from 150 kg to 290 kg)[5].

Key uses include transport, and especially the automotive sector, where aluminium is used for components such as wheels, chassis, transmissions, but also increasingly for car bodies and battery cases. Other sectors in which there is huge demand include construction (facades, windows, doors, etc.), and packaging, where aluminium is increasingly used for fully recyclable beverage cans, as well as in a wide range of foil applications. It is a perfect barrier for keeping foodstuff and drinks fresh and safe, and thus helps to prevent food waste.

European Aluminium projects continued growth in aluminium use, leading to a 40 percent increase in demand in Europe by 2050. Estimates show that 16 million tonnes of aluminium will be used in 2030 and 18 million tonnes in 2050. Some of the predicted growth in demand is expected to be generated by aluminium replacing other materials (like steel, copper, plastics, PVC, wood depending on the markets).

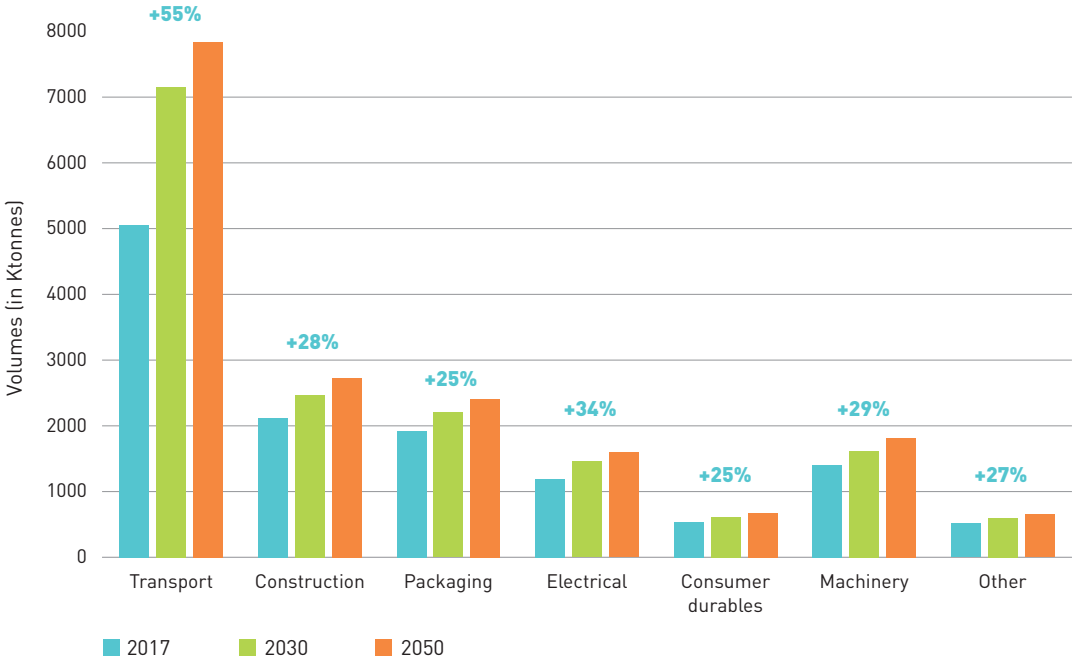
[4] Europe is EU28 + EFTA countries (2019)

[5] World Aluminium – global mass flow model

Some of this growth's drivers are:

- Automotive: due to its light weight, new uses and applications for aluminium will be found within the automotive sector to reduce vehicle emissions. The increased focus on electric vehicles may also accelerate demand growth as saving weight can help to cool down their batteries, increase their range and improve safety.
- Construction: The European Green Deal heralds a 'building renovation wave' and the 'rigorous enforcement of legislation related to the energy performance of buildings', both of which are expected to speed up efficient aluminium solutions in the construction sector. Aluminium is commonly used in facades, window frames, shading devices and HVAC systems (Heating, Ventilation and Air Conditioning). Low-carbon electricity systems also depend on aluminium for many components such as solar panels, wind power plants and high voltage power grids.
- Packaging: The pressure on non-recyclable and non-recoverable packaging has increased since the adoption of the EU Single Use Plastics Directive in 2019. All beverage containers, including aluminium beverage cans, need to be collected and recycled in a near future at rates of at least 90 percent. Composite (laminated) packaging has to be redesigned in order to make it suitable for sorting and recycling. Providing it is properly collected and sorted, aluminium packaging can be recycled multiple times while maintaining its properties.

Figure 1: Demand for semi-finished aluminium in Europe per sector
Million Ktonnes aluminium in year 2017, 2030, 2050
Source: CRU data, 2018



1.2 As aluminium use grows, making it even more circular is essential

As more aluminium is fed into the economy, more will also exit due to products reaching their maximum useful lifespan.

Recycling of end-of-life aluminium is already significant. Aluminium recycling rates are among the highest compared to other materials: in Europe recycling rates are over 90 percent in the automotive and building sectors, and 75 percent for aluminium cans.

However, aluminium products have a long lifespan; on average they are in use for 50 years in construction and 15 years in transport. Their longevity – added to the growing demand for aluminium – means that the amount of aluminium reaching its end-of-life and available as post-consumer scrap is limited.

The amount of aluminium in products reaching the end-of-life (EoL) constitutes a "pool" of aluminium scrap which can be reintroduced into the circular economy.

Figure 2: Post-consumer aluminium explained

Post-consumer aluminium	
Origin	• Products reaching their end of life due to age or replacement • Products that have been on the market from all geographies and applications
Driver	• Historical use of aluminium, with a growing demand worldwide • Existing incentives for end-users to bring back the products after product use • Amount of available post-consumer scrap depends on life-time of products and volume of metal used in society
Collection	• Varying collection rates depending on product types • The material comes through many channels like municipal waste, collection systems and scrap yards
Sorting	• Extensive sorting needed for efficient scrap preparation • Any alloy types can be in the mix • Some fractions are difficult to sort since they are attached to other materials • Packaging may contain food or other non-aluminium waste
Quality	• Needs sorting as any alloy types can be in the mix • An important share of post-consumer aluminium is made into high quality cast alloys • Many streams are, however, challenged with contamination of other materials and/or metals

Pre-consumer scrap: is defined as the scrap generated during the transformation of semi-finished products into finished products. Consumption of semi-finished products is the main factor which determines the supply of pre-consumer scrap. Fabricator yields play an important role in determining the supply of pre-consumer scrap. Some semi-finished products, such as autobody sheet, produce more scrap when turned into a finished product than other types of semis. Pre-consumer scrap is relatively easy to sort and has high economic value, with some variations depending on its origin. The objective is to further improve production efficiency to limit pre-consumer scrap and for the remaining volumes, ensure good recovery in the system.

Based on consumption forecast, the amount of post-consumer aluminium available for recycling will more than double from 3.6 million tonnes per year in 2019 to 6.6 million tonnes in 2030, reaching 8.6 million tonnes by 2050. By mid-century, 50 percent of our needs for aluminium could be supplied through post-consumer recycling.

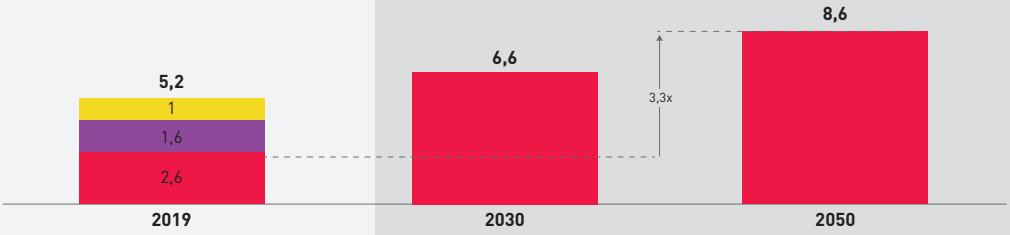
The pool of End-of-life aluminium scrap available is composed of:

- End-of-life aluminium scrap used in Europe (which represents the largest part)
- End-of-life aluminium scrap exported (legally and / or illegally)
- End-of-life aluminium not collected (e.g. ending up in landfill) or lost during the collection and the recycling process (e.g. oxidation, etc.)[6]
- End-of-life aluminium collected and recycled without proper registration (e.g. collection by the informal sector).

The EU exports[7] 1 million tonnes of aluminium scrap per year to other regions (mainly Asia). Even though this scrap is highly likely to be recycled due to its high value, its export represents a loss for the European economy.

Figure 3: Total use of post-consumer aluminium by 2050
Source: CRU data - 2019.

Million tonnes end-of-life aluminium, 2019, 2030 and 2050



- Total use of post-consumer aluminium in Europe
- Aluminium scrap exported out of Europe
- EoL aluminium available in Europe, but not used nor exported today, i.e. EoL aluminium lost during collection and recovery, EoL aluminium in products (e.g. cars) which are exported legally or illegally or aluminium scrap landfilled.

- Under the right conditions, we could have a high recycling scenario where the use of post-consumer aluminium in production to meet demand could increase significanty.
- The availability of end-of-life aluminium depends on how much aluminium had entered the market so far and the life span of products.
- As the demand is still growing, the availability of post-consumer aluminium will also continue to grow.

[6] The EoL aluminium lost during collection and recovery is in fact not lost: when it ends up in incineration most of it can be retrieved through bottom ash treatment.

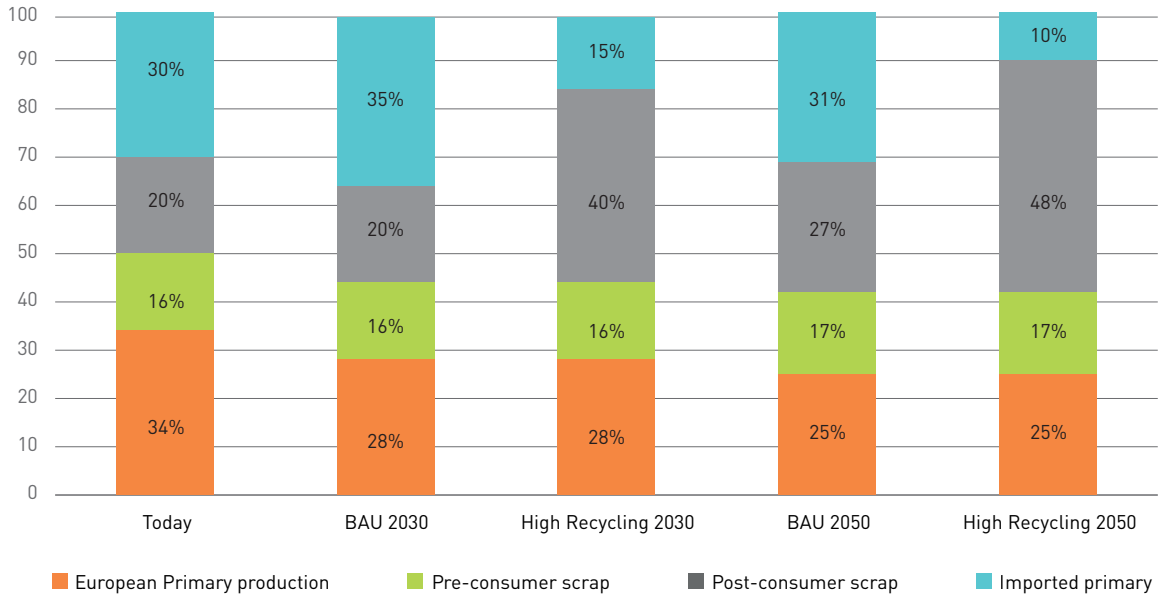
[7] CRU data of exported post-consumer aluminium scrap

The aluminium industry wants to ensure that all types of scrap generated are minimised and recycled in the most efficient way and are of high quality.

There is an opportunity to lay the foundations of a perfect circular material system. Such a system should reduce – if not eliminate – the various "loopholes" linked to losses of EoL material in the collection and recycling phases. Providing more information on the recyclability of material being introduced into the market, and consistently demanding design for circularity would ensure higher rates of collection, sorting and recycling. A perfectly circular system should limit exports of scrap provided that recycling facilities operate at the high environmental, health and safety standards required in Europe. Achieving these targets will require investment in re-melting and refining capacity, as well as more efficient sorting within the overall value chain to improve the quality and quantity of material recovered.

Recycled aluminium already makes a significant contribution, representing 36 percent of the aluminium metal supply in Europe (20 percent being post-consumer, 16 percent pre-consumer scrap) but greater opportunities lie ahead. There is potential to meet close to 50 percent of demand with post-consumer aluminium by 2050

Figure 4: Metal supply - 2019, 2030 and 2050
Source: CRU, 2019.



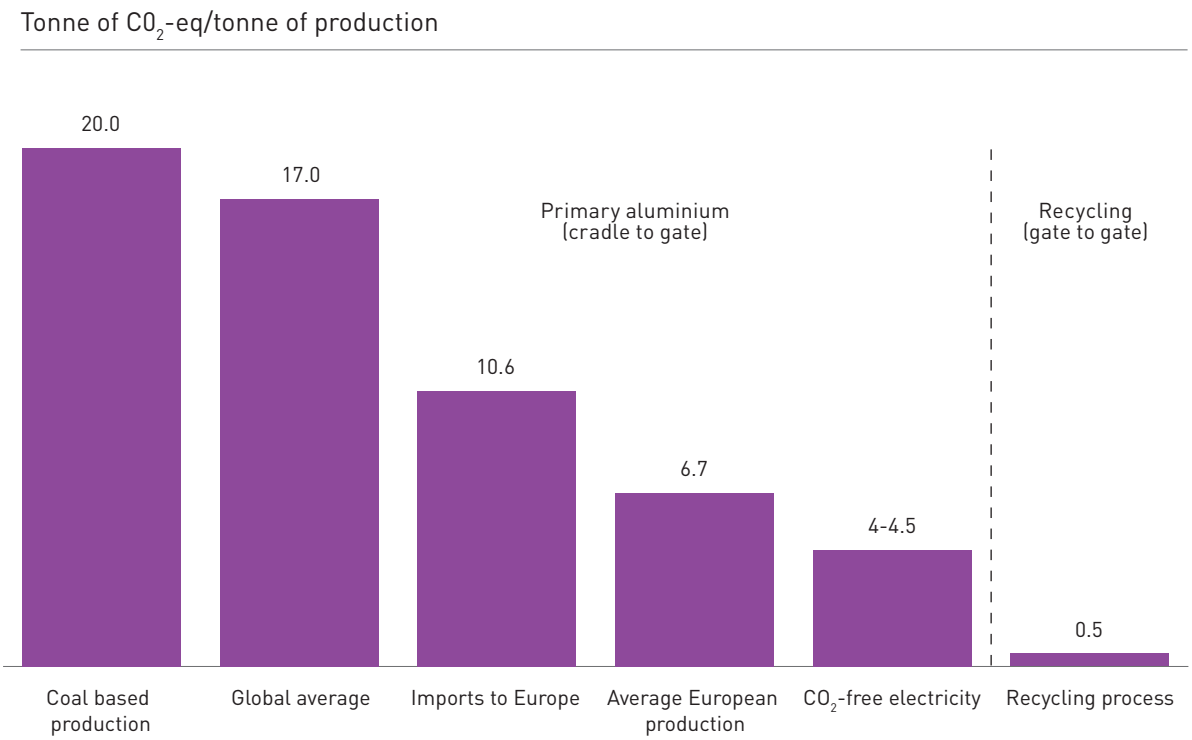
1.3 Aluminium recycling helps avoid CO_2 emissions

The need to cut greenhouse gas emissions only emphasises the importance of aluminium recycling. Aluminium is traded globally and, to meet current demand, the EU imports close to 30 percent of required primary aluminium. Depending on their region of origin, aluminium imports can have very different greenhouse gas emissions.

Given this, recycling aluminium provides an opportunity to cut greenhouse gases by replacing the import of primary aluminium. Aluminium recycling process requires only 5 percent of the energy needed to produce the primary metal, resulting in greenhouse gas emissions of 0.5 tonne CO_2 eq/tonne recycled aluminium (gate to gate). It does not include the inherent carbon footprint of the aluminium scrap.

Both primary and recycled aluminium will be needed in order to meet the demand. Keeping production within the EU, however, is both economically and environmentally beneficial. It is important to ensure that all end-of-life aluminium products are collected and recycled efficiently in Europe to maximise aluminium recycling rates and to keep the material in active use.

Figure 5: Greenhouse gas emissions of primary aluminium production and recycling process
Source: Coal based production and global average: Life cycle inventory data and environmental metrics for the primary aluminium industry, World Aluminium, 2015. Addendum, August 2018.
Other: Environmental Profile Report 2018, European Aluminium



According to estimates, the climate contribution of aluminium recycling could be a reduction of 46 percent of CO_2 per year in 2050; achieved mostly by replacing the imports of carbon intensive primary aluminium with recycled domestic post-consumer aluminium.

Figure 6: CO_2 emissions avoided by replacing import of primary aluminium with recycled aluminium in Europe
Million tonnes CO_2 eq per year, 2019 and 2030 (Business as usual (BAU) or high recycling)

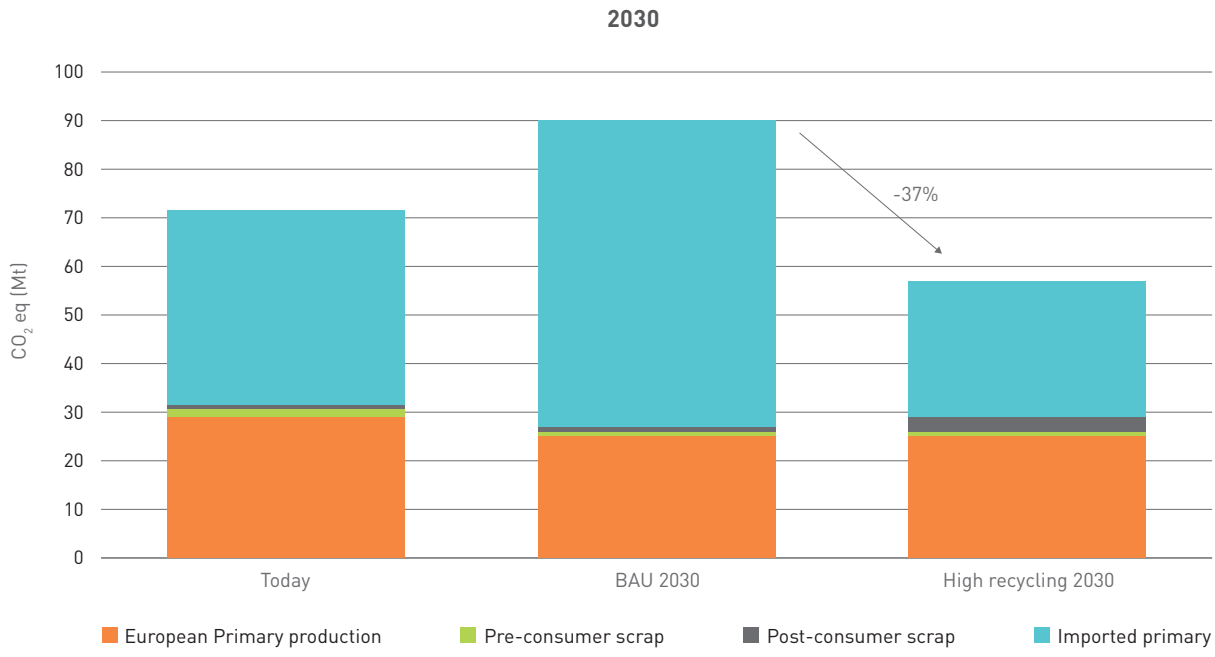
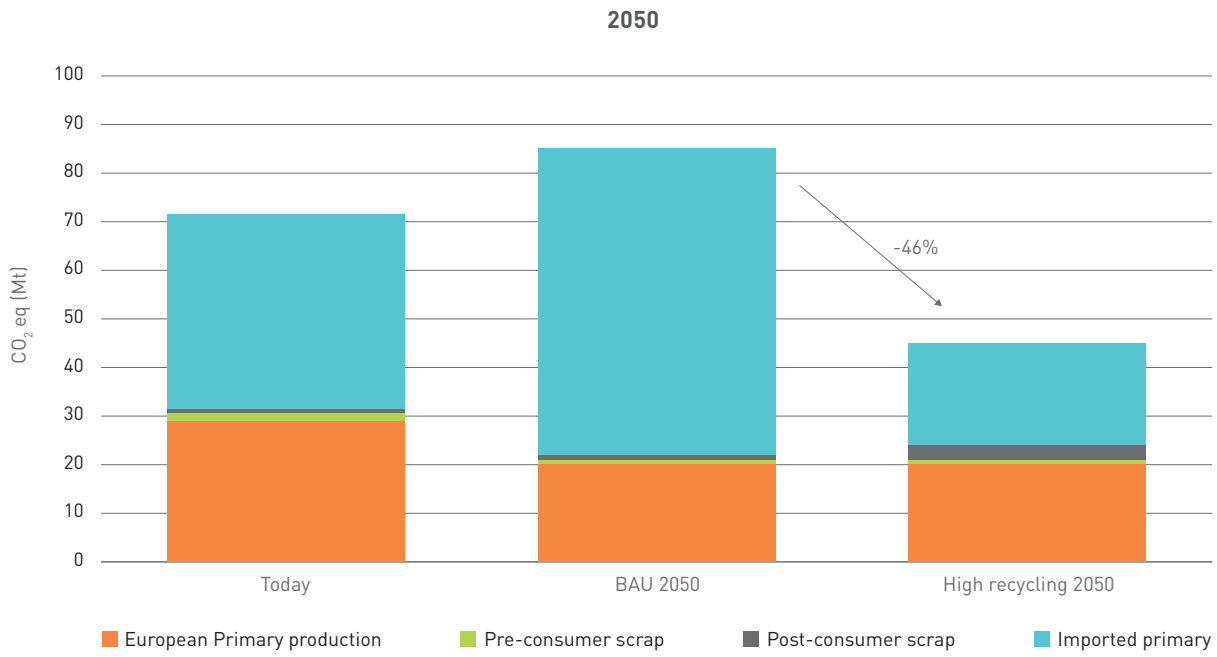


Figure 7: CO_2 emissions avoided by replacing import of primary aluminium with recycled aluminium in Europe

Million tonnes CO_2 eq per year, 2019 and 2050 (BAU or high recycling)



- *"Business as usual"* (BAU) scenarios consider import with carbon footprint equivalent to average imports today and the equivalent proportion of recycled aluminium.
- *"High recycling"* scenarios consider import with the worldwide average carbon footprint and a high proportion of post-consumer recycled aluminium.
- All scenarios assume an efficient recycling of pre-consumer scrap as it is today. (If pre-consumer scrap would not be recycled, it would need to be replaced by primary aluminium).

In a high recycling scenario, by 2050, increased recycling of aluminium could reduce emissions by 37 percent by 2030 and 46 percent by 2050; equivalent to avoiding 39 million tonnes of CO_2 emissions per year. This scenario would also reduce Europe's dependence on carbon intensive primary aluminium imports. It assumes that producing recycled aluminium will generate a CO_2 emission of 0.5 tonne / tonne and will substitute the equivalent quantity of primary aluminium imported into Europe (which today has an average CO_2 emission of 10.6 tonnes of CO_2 eq/tonne of aluminium).

Estimates in Vision 2050[8] show that primary production in Europe will be 70 percent less carbon intensive both for direct and indirect emissions for smelting operations, and 48 percent less carbon intensive from a cradle to gate (i.e. from bauxite to ingots). Because of the decarbonisation of electric grids and a mix of incremental and breakthrough technologies, it will be possible to further reduce direct emissions from primary production processes. Emission created by European primary aluminium production in the three different scenarios is reduced from 6.7 tonnes of CO_2eq/ tonne of aluminium, to 5.5 tonnes of CO_2eq/ tonne of aluminium in 2030, and 4.5 tonnes of CO_2eq/ tonne of aluminium in 2050.

[8] Vision 2050, European Aluminium's contribution to the EU mid-century low carbon roadmap, March 2019 https://european-aluminium.eu/media/2545/sample_vision-2050-low-carbon-strategy_20190401.pdf

02

ACHIEVING A PERFECTLY CIRCULAR ALUMINIUM SYSTEM

2.1 Economic value of aluminium recycling could multiply by four

Collecting all the available aluminium in Europe is not only an emission reduction initiative, it is also a significant economic opportunity that can help safeguard the European aluminium industry by meeting increasing domestic demand for aluminium. The recent trend has been to import primary aluminium as European primary producers have struggled to compete with the expanding subsidies provided for the production of carbon intensive aluminium produced in China.

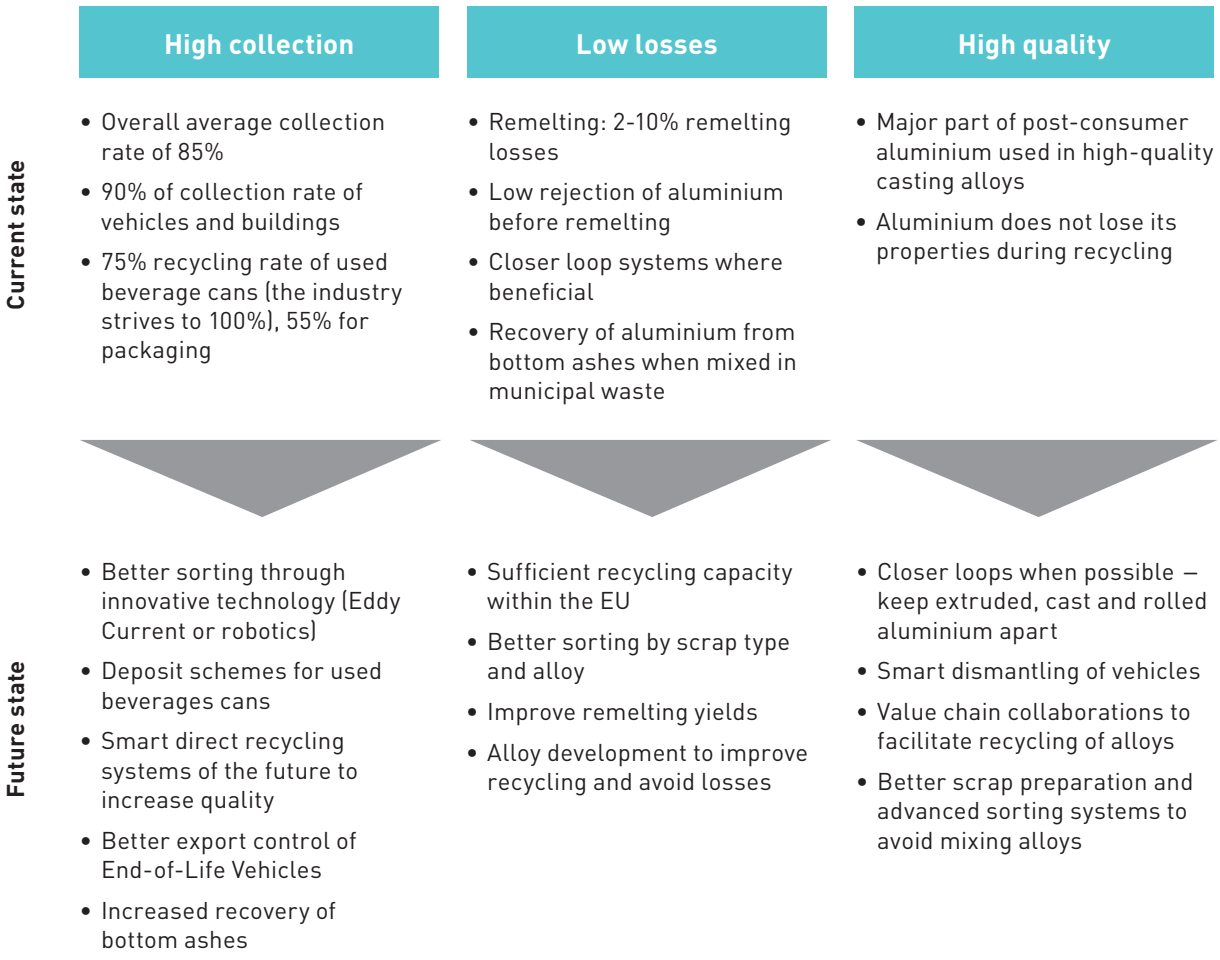
Europe's high recycling rates for aluminium are achieved due to well-developed collection systems – especially for End-of-Life Vehicles; building scrap and used beverage cans; high scrap sorting rates; low losses when aluminium is re-melted to recycled metal; and a high-quality end product which can be used in high value applications. The result is a system driven by the intrinsic value of the metal. Recycling can therefore directly replace new primary production, and thereby the high CO_2 emissions associated with carbon-intensive aluminium imports.

Today the reprocessing of end-of-life aluminium into a new, valuable raw material is a €3 bn[9] market. In addition, the 1 million tonnes of aluminium scrap exported yearly represents a loss of around €960 million to the European economy. With an increasing volume of scrap accessible in Europe, recycling of end-of-life aluminium can grow to a €12 bn market by 2050 allowing the aluminium industry to capture the full economic opportunity.

Using aluminium contained in products at the end of their life means utilising the raw material available in Europe and being less dependent on bauxite, alumina and primary aluminium imports. This reduces companies' exposure to any supply insecurity that could arise from a continued growth in dependence on imports.

[9] Current recycling activities generate €6 bn of which 55 percent is post-consumer aluminium. Using the same generated value per ton in 2050 gives a number of €12 bn (Source: European Aluminium).

Figure 8: The aluminium industry defines recycling as:



Looking ahead, aluminium can become even more circular. Higher collection rates of a larger pool of end-of-life metal, even lower losses, and continued high-quality recycling can continue to replace primary production, with all the associated resource and economic gains.

Each part of the recycling process will have to be improved and have capacity added. The right EU policy environment can play an important role in lowering the risk of investing in an uncertain market, creating incentives for circular solutions and products and ensuring proper implementation of the existing legislation.

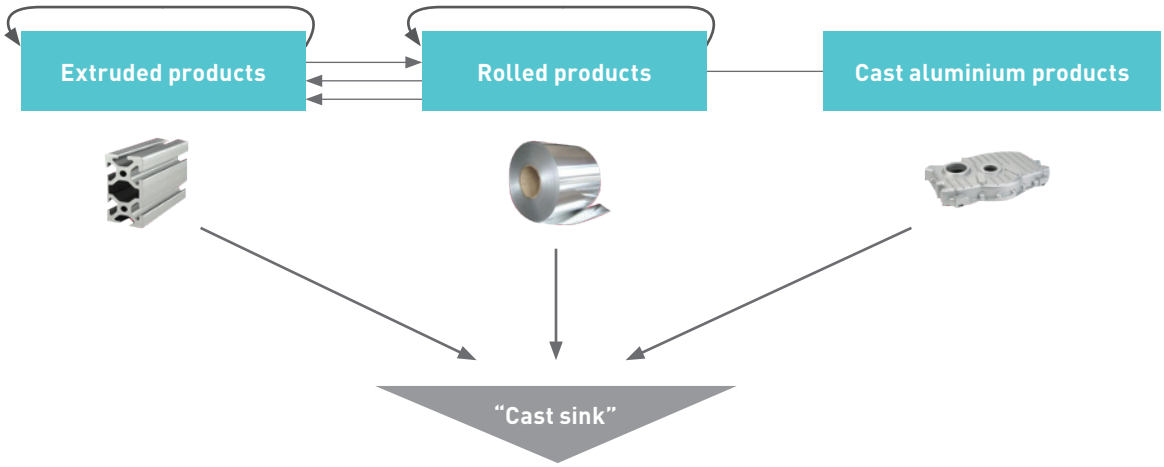
2.2 Aluminium strives for more

While today, recycled aluminium's main route is still for cast aluminium production, in the future sorting of end-of-life aluminium products should be improved to enable the material to come back into the market to serve the same purpose as the original product (rolling, extrusion or cast products). The future system as proposed by the aluminium industry would maximise the added value for recycled aluminium.

At the core of our ambition to collect, sort and recycle larger volumes of aluminium are the three main value chains: transport, construction and packaging. Each sector has its own challenges, but they are all working to achieve the same goals: higher end-of-life recycling results including closed loop recycling, thus adding more value to the aluminium production chain in Europe.

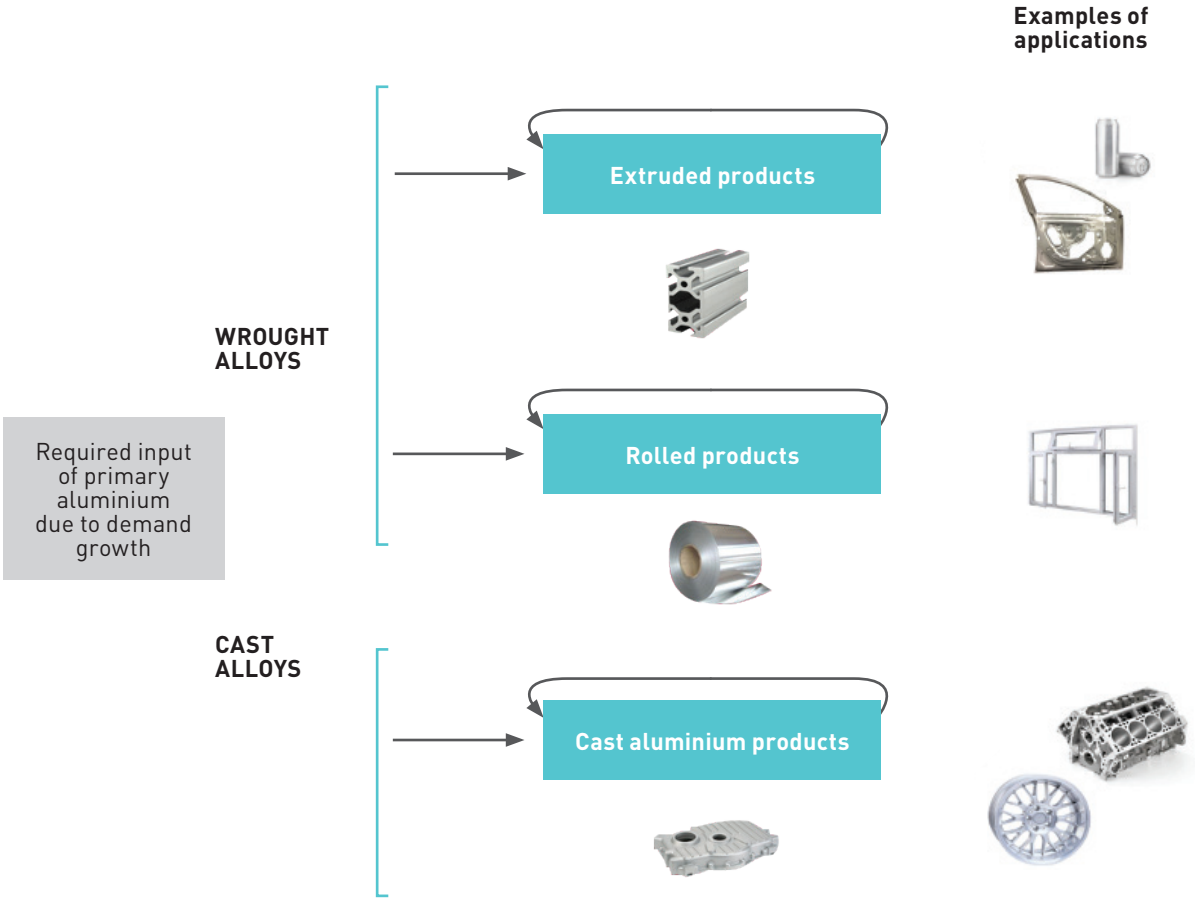
Potentially, even more could be achieved when considering other value chains such as aerospace, electronics and electrical applications, consumer goods and machinery. The deployment of solar panels and wind turbines in Europe will accelerate in the next decade and many will reach their end-of-life around 2030, providing additional volumes of end-of-life scrap to be recycled.

Figure 9: Aluminium scrap of different alloys are often mixed today, restricting recycling to casting alloys



In the future recycling system, aluminium products will be separated into closed loops, which enables the material to come back into the market to serve the same purpose as the original product for multiple uses.

Figure 10: Aluminium scrap of different alloys should be sorted and recycled separately for a fully circular system



2.3 Driving the transformation needed to achieve full circularity

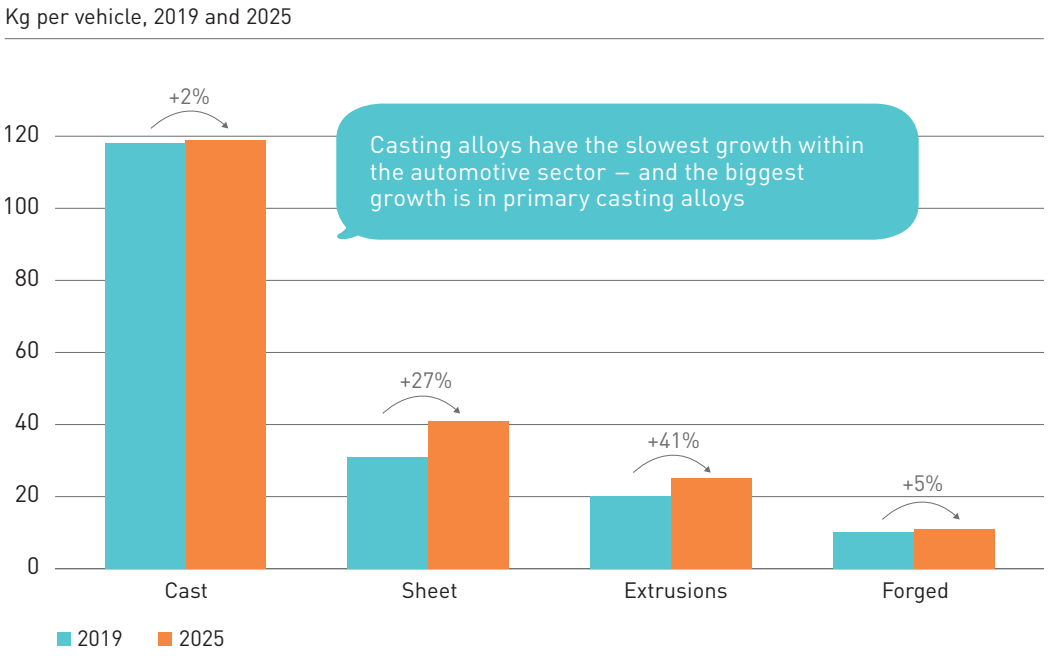
One major development that will impact the aluminium industry is the recovery of larger volumes of post-consumer aluminium. It will need to invest and to adapt to ensure continued high recycling rates and high quality output.

The second major shift is happening in the automotive sector. The use of aluminium in the automotive sector will continue to grow, as light weighting and other benefits that aluminium provides are important for electric vehicles. However, the use of recycled (also named 'secondary') cast aluminium, specifically for engine blocks, may in fact fall, as cars with combustion engine drive trains will occupy a smaller market share. As the amount of end-of-life aluminium grows in volume, the industry must find new uses applications for its use.

These two shifts are happening in parallel, and an increase in car production is unlikely to absorb the increasing volume of high-quality post-consumer aluminium scrap; at the same time, increased exports would result in the EU losing a valuable resource.

One of the biggest challenges for the sector is the export[10] of 1 million tonnes of aluminium scrap per year leaving Europe to other regions (mainly Asia). Even though this scrap is highly likely to be recycled due to its high value, its export represents a loss for the European economy.

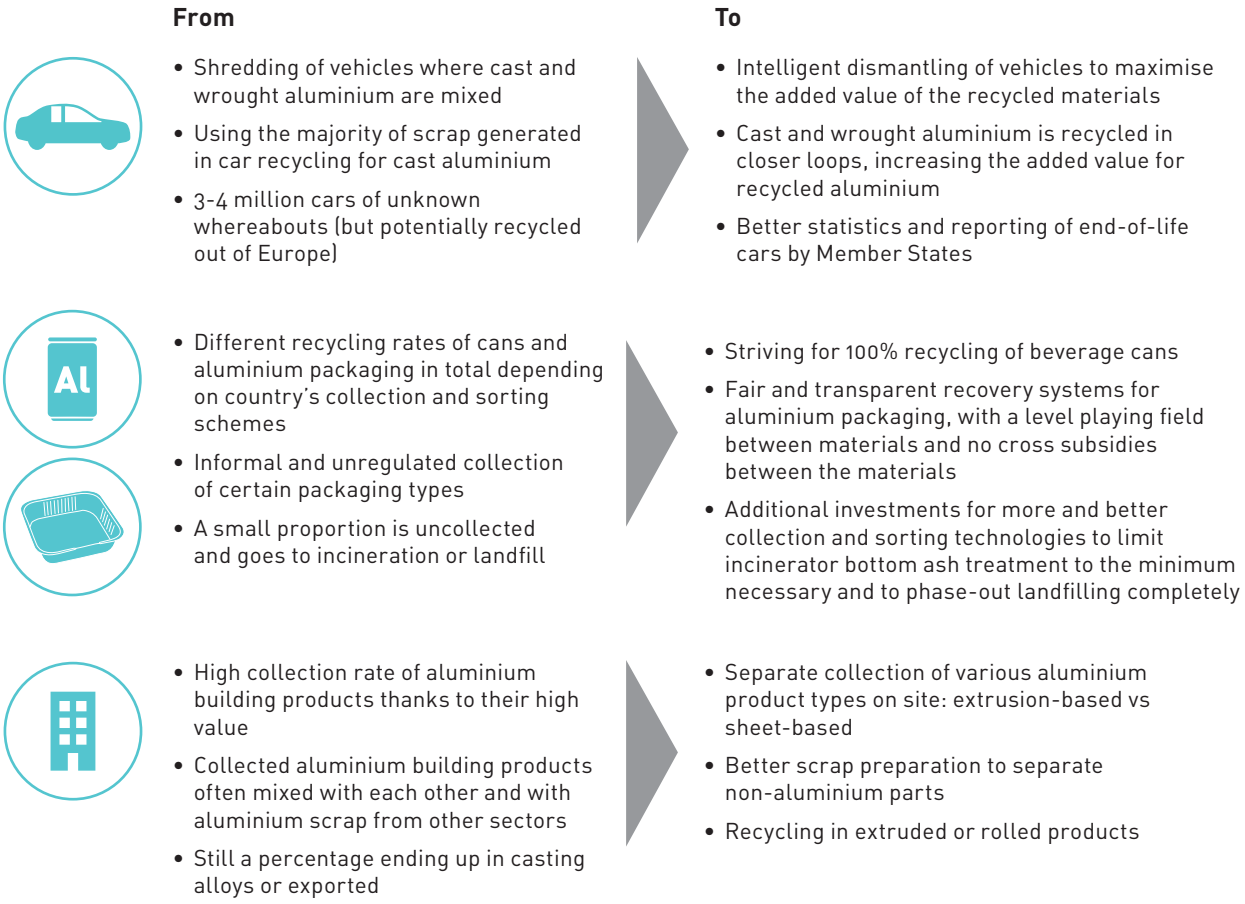
Figure 11: Aluminium content in cars per forming process
Source: Material Economics



Note: casting alloys are classified as primary or secondary casting alloys. Today, primary casting alloys are based on primary aluminium due to strict specifications. Secondary casting alloys are mostly based on recycled aluminium.

[10] CRU data of exported post-consumer aluminium scrap

Figure 12: From "good to great" for the main applications



Transport: transforming the recycling system to recover the increasing volumes of aluminium in cars

For cars, the main challenge is to achieve a recycling procedure that makes it possible to separate wrought and casting alloys to allow their recycling into both wrought and casting alloys in new components. Cars are a special case in the aluminium recycling loop. European legislation recognises End-of-Life Vehicles (ELVs) as an important waste and materials stream, both in terms of hazardous substances and as a source of materials. The ELV Directive requires each Member State to ensure all vehicles are collected, treated and recovered, and now requires that 95 percent of all materials in ELVs are recovered and 85 percent is reused or recycled. In many ways, this has been very successful. For aluminium, more than 90 percent of the metal is recycled in today's modern treatment facilities.

Figure 13: Increased dismantling prior to shredding would be beneficial for all materials in a car

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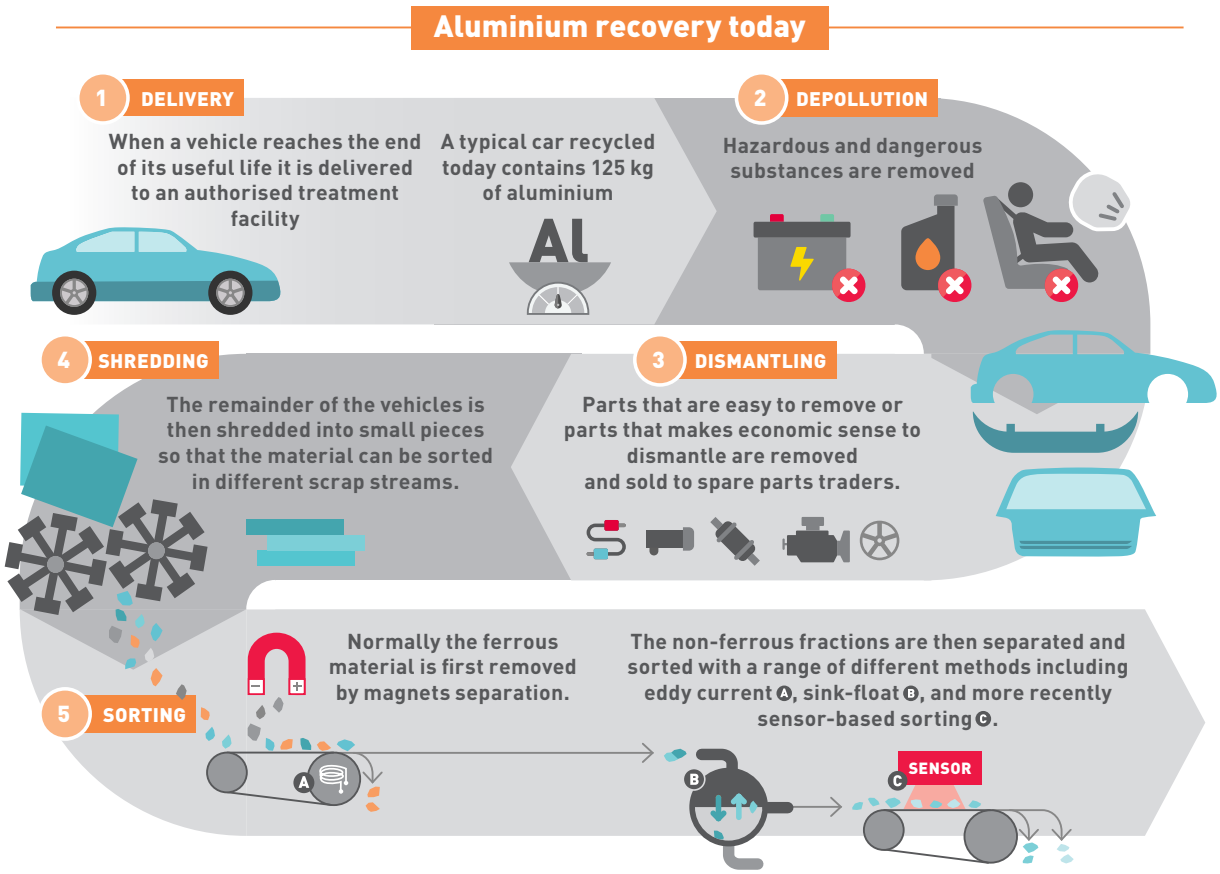
Only dismantling of components that can be sold or must be removed by law before shredding. Creating a mix of materials that are separated after shredding.



Key facts

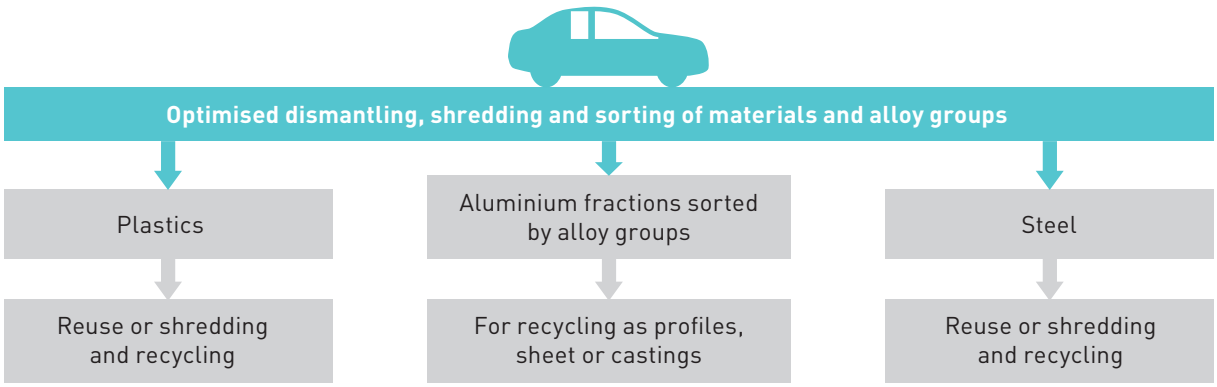
In today's modern plants 95% of the aluminium in an End-of-Life Vehicle is successfully and profitably reused or recycled into new aluminium products substituting primary aluminium.

Making a vehicle lighter and recyclable are compatible goals. Using aluminium will contribute to making the vehicle more efficient through lightweighting and to ensure high recycling rates at the end of life.

The recycling of aluminium allows to reduce the energy consumption by 95% compared to the production of primary aluminium, thus representing a clear environmental benefit.

To...

More selective dismantling by materials and by alloy groups before shredding and keeping separate recycling routes to avoid contamination from other materials or high mix of alloys.



However, the End-of-Life Vehicles (ELV) Directive has focused only on volumes, with no attention given to preserving the value and quality of materials. As metals are not sorted properly, this creates problems such as steel becoming downgraded when mixed with copper, and aluminium often being mixed and lost with steel.

For aluminium, the current shredding process leads to a mixing of wrought and cast aluminium components. As noted above, this can be reprocessed into highly alloyed aluminium for casting applications. But as the amount of aluminium from ELVs grows while the proportion of cast aluminium parts falls, the solution could be to increase dismantling and sorting of components before any shredding takes place.

This is even more important as the volume of aluminium in cars is growing. A recent study[11] by Ducker suggests that the aluminium content in cars is set to increase by 40 percent by 2028. This means that car recyclers are at the beginning of a new era of recycling.

The automotive sector is better positioned than any other sector to increase the quality of end-of-life aluminium. However, collaboration along the whole value chain to help change current practices is necessary.

The current process - focussed on shredding cars for the recovery of steel - needs to be improved because an increasing amount of the value of materials in a car is found in aluminium and other materials.

To summarise, three things need to happen in car recycling for the circularity of aluminium to be improved:

- **Cars must be designed for recycling**, all the way from design for disassembly and separation of materials to awareness of material development.
- **Recycling of cars needs to shift from 'full shredding' to a recycling practice that treats more components separately.** Given the current status and cost of available technologies, sorting the aluminium waste stream after shredding of a full car body will never achieve the same quality as treating components differently from the beginning (a practice that would also benefit other materials).
- **More cars need to enter the European recycling system.** Despite the ELV Directive, a lot of cars are treated outside the EU. Based on the European Commission's assessment[12] the number of the so-called ELVs of unknown whereabouts translates into around 600,000 tonnes of aluminium per year.

[11] Ducker Frontier, October 2019 https://www.european-aluminium.eu/media/2714/aluminum-content-in-european-cars_european-aluminium_public-summary_101019-1.pdf

[12] Unknow whereabouts are the vehicles that are deregistered but without a Certificate of Destruction issued or available to the authorities and also with no information available indicating that the vehicle has been treated in an authorised treatment facility or has been exported. https://ec.europa.eu/environment/waste/elv/pdf/ELV_report.pdf

Those developments could benefit other transport modes and applications (road, rail, aerospace, building, consumer goods, etc.) in particular when it comes to dismantling and sorting by alloy groups.

Packaging: improve the overall packaging recycling rate and strive towards 100 percent recycling of beverage cans by 2030

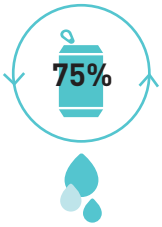
Depending on the various collection and sorting systems in place, it can be challenging to meet more ambitious packaging recycling targets. Considerable losses occur during the recycling process, in particular for composite packaging, making it difficult to sort and separate the different components and materials. Except for metals and glass, the result often is a material of significantly lower quality than the virgin equivalent, making it difficult to replace virgin packaging materials with recycled ones.

The recycling of aluminium packaging is organised via a wide range of different collection and sorting systems in Europe, generally generating very good results but with variations from country to country. In order to ensure higher recycling rates in medium to low performing countries, these collection and sorting systems need to be expanded and improved.

Figure 14: Aluminium packaging is aiming for closing the loop - example of the beverage can

From...

... average collection rate of 74,5% across the EU. Used beverage cans used for multiple applications.



- Broad range of collection and recycling rates
- Only 20% of volumes collected through deposit return systems, which limits the likelihood for can-to-can recycling[13].

To...

... striving to reach a 100% recycling rate all over Europe with every can going back to the market as a new can.

- Fair and fully implemented effective recovery systems change to: (including deposit return systems) resulting in clean streams of end-of-life cans
- Sufficient remelting and rolling capacity within European borders
- Closed loop for beverage cans and other suitable packaging solutions

[13] Based on an extrapolation of the annual aluminium beverage can recycling rates for EU + EFTA as published by European Aluminium and Metal Packaging Europe

With the introduction of new EU reporting rules[14] from 2020 onwards, the recycling rate of the various used packaging materials could be significantly lower. This might range from 10-15 percent less for metals and up to 20-30 percent less for various types of plastics. To understand the full benefits of recycling on resource availability and consumption however, the impact of 'downcycling' needs to be taken into account. Materials with permanent properties such as aluminium and steel do not degrade during recycling while other materials are subject to serious downcycling, meaning that they are no longer useable after a few recycling trips. As a consequence, this material is – in the end – lost, while aluminium remains available for at least 20-30 recycling trips or more.

The potential to achieve very high recycling rates for aluminium beverage cans is already a proven fact, reaching more than 95 percent in some countries. With an EU average of 74.5 percent for beverage cans, there is, therefore clear scope for improvement.

Finally, in sharp contrast to other packaging materials, it is possible to recycle aluminium beverage cans to a product with similar quality as the original, virgin or recycled metal. Efficient collection systems that target cans produce a very clean stream of end-of-life aluminium. The goal, in a circular economy, must be to keep the material circulating without it losing its properties. Closed loops for beverage cans can achieve precisely this. While recycling cans into new cans creates a perfect closed loop, high-end uses in other valuable products are also recommended.

Achieving high recycling rates throughout the EU and mobilising the recycling capacity for re-melting and rolling, in order to process the resulting metal into new cans, is perfectly doable. And it makes economic sense to do so.

[14] New packaging waste recycling targets for 2025 and 2030, including now separate targets for aluminium, to be implemented by the EU Member States in 2020 (and they might table higher targets than the EU minimum targets of 50 percent, respectively 60 percent). Aluminium data will be collected separately (and cannot be reported anymore together with steel under the overall metal packaging fraction). The new recycling rates are based on a new measurement point, after the final sorting phase at the input into the recycling operation (sorted metal that does not undergo further processing before entering a metal smelter or furnace). Aluminium recovered from bottom ash can be included in the recycling rate and must be reported separately.

Nonetheless, achieving this will likely depend on smart regulatory intervention in combination with new technology and collaboration along the value chain. Concrete options include:

- **Phasing-out landfilling of aluminium recyclable aluminium waste** as soon as possible and improving collection and sorting infrastructure will contribute to larger collected volumes, better sorting and in turn achieve an output of better material quality;
- **The use of innovative sorting equipment** such as advanced Eddy Current separators and inductive sensor-based sorters, sometimes in combination with pyrolysis pre-treatment in order to get rid of any remaining contaminations;
- **Deposit-Return Systems (DRS)** can be successful in certain circumstances for beverage cans as they generate a clean stream of metal that can be reused for packaging. However, they need careful consideration, as they do not always include other types of competing packaging containers. To avoid the need for customers to return packaging to a specific collection point, innovative DRS using smartphones and product tags can be used. Tags can also be used on bags so that consumers can tag a bag and leave it in the usual recycling systems or in the curbside collection system.

Construction: volumes of end-of-life aluminium are becoming large enough to work in closer loops
The construction sector is another sector set to experience increasing volumes of end-of-life aluminium. The sector stands out because of the dominance of low alloyed aluminium and large components which make collection, identification and separation easy. The scrap therefore has large potential for being used in the same application again provided that demolishers and traders understand the value of the material and avoid mixing it together with other products.

The construction sector is reaching a tipping point where volumes of end-of-life aluminium are becoming large enough to justify separate treatment. Furthermore, sorting technology is evolving rapidly, and new plants are emerging that can produce high purity aluminium fractions suitable for re-melting into new extrusion billets or rolling slabs, with minimal input of primary aluminium.

To capitalise on these new opportunities, it is important that different aluminium product types (e.g. extrusion-based vs. sheet-based) are collected separately on demolition sites; and that new sorting and re-melting technologies are deployed to facilitate recycling into new extruded or rolled products.

Where practically possible and economically viable to create closed loops in the construction market, improving collection and sorting are two important paths for the aluminium industry to follow.

03

THE ROAD AHEAD

The European Circular Economy Package, presented in 2015 and adopted in 2018, signalled a major shift in industry thinking and operations; from changes in waste management to changes in business models. The aluminium industry did not wait for the proposal to be adopted by policy makers to enhance the circular use of its material.

The circular economy is the clear way forward and our industry is already driving the transformative changes that are needed. The next Circular Economy Action Plan should be an accelerator of the transformation that is already happening and focus on nurturing a value chain approach, which requires all actors to work in closer collaboration.

Without the right policies in place, Europe may not be able to deliver the full potential of the circular economy at the pace that is required to reverse the trend of climate change and depletion of resources.

3.1 Policy recommendations from European Aluminium

Policy support will be needed to enable research, to coordinate measures along the value chain, to influence market demand for circular solutions and consumer awareness, to make investments economically viable, and to develop the business models required to underpin them. European Aluminium calls upon the institutions of the European Union to boost the circular economy and to recognise multiple recycling as key to preserving resources, mitigating emissions and spurring economic growth in Europe.

Figure 15: Overview of policy recommendations

<table>
<tr><th colspan="2">Circular material handling</th><th colspan="2">Incentives for circular solutions and products</th></tr>
<tr><td>Designing circular products</td><td>Remove barriers in the internal market and loopholes in the legislation</td><td>Support innovation in collection, dismantling and sorting technologies</td><td>Stimulate innovation in melt purification and recycling-friendly alloys</td></tr>
<tr><td>Improve collection and sorting</td><td>Limit scrap exports</td><td>Recognise the role of recycling in mitigating climate change</td><td>Stimulate demand for circular solutions</td></tr>
<tr><td colspan="4">Further stimulate collaboration along the value chains
As an overarching principle, it is essential to improve collaboration along the value chains. There is no circular economy if the business models behind it are still based on the old “linear” approach.</td></tr>
<tr><td colspan="4">Enforcement: Ensure implementation of the current legislation
Enforcement of existing legislation, in particular the new requirements under the Waste Framework Directive (e.g. phasing out of landfill) and the Packaging and Packaging Waste Directive (e.g. ensuring Member States report the correct quantities for their recycling results with the new reporting methodology) is a second condition for an effective circular economy.</td></tr>
</table>

3.2 Circular material handling

1. Designing circular products

Objective: The design of products can improve the various steps in the recycling value chain. We encourage smart design to make material identification, disassembly and recycling easier and more cost efficient.

What needs to be done: EU legislation should enhance the potential of product design to enable better recycling of material at the end-of-life. Products should be designed in a way that creates economic value for manufacturers (and other businesses) to collect, sort and recycle the various materials used at the end-of-life.

Requirements for ‘design for recycling’ and ‘design for disassembly’, which are already included in existing regulations (e.g. End-of-Life Vehicles Directive), should be enforced properly. New products put on the market should be automatically designed with these requirements at the forefront.

EN standards to measure the recyclability of products should be further developed (e.g. based on the recently published EN 45555:2019 under the Ecodesign Directive) and criteria should be developed to promote recycling-friendly products and multiple recycling. In addition, standards to measure the environmental value of recycling should be developed in order to quantify the environmental benefits of recycling each material. This will enable recycling efforts to be directed towards the most relevant materials.

2. Improve collection and sorting

Objective: The shift to circular business models requires innovation in technologies and practices as well as investment in higher capacity for collection and sorting of secondary material. For Member States to achieve the respective 2030 and 2035 targets, investment decisions must be made within the next five years.

What needs to be done per main application:

Packaging: Public authorities and waste management companies should invest more in collection systems and modern waste treatment centres, using the latest available sorting technologies.

If not yet in place, Member States and local authorities should be encouraged to:

- Increase separation of aluminium from curbside collection waste streams and municipal waste
- Implement separate collection systems and invest in modern sorting technologies like Eddy Current technology and additional scrap preparation
- Consider the economic value of the aluminium scrap fraction as a key incentive for such investment

The high aluminium scrap value as well as the permanent properties of aluminium should be reflected in the eco-modulated fees set by the Extended Producer Responsibility (EPR) schemes for offsetting the costs of multiple-recyclable materials scrap collection and sorting routes.

Transport: Ensure that ELVs are recycled in Europe and promote better material identification. In addition, increased dismantling of specific parts before shredding and separate treatment of these dismantled parts should be promoted; for example, big components with a limited number of materials that can then be shredded and recycled separately. Examples of parts that could be dismantled before shredding to improve the recycling rates are engines, heat exchangers, doors, bonnets, fenders, bumpers and gearboxes.

More generally, increased technical requirements should be introduced into the ELV Directive regarding the treatment operations needed to promote recycling.

To facilitate the most appropriate treatment of ELVs by recyclers and dismantlers it is important to have more complete information in the International Dismantling Information System (IDIS), not only concerning dangerous substances.

For the rest of the ELVs that could not be dismantled, processing plants and manufacturers should be required to accelerate the development of post-shredder separation technologies.

Building: Promoting best collection practices to avoid building products scrap (often mono alloy) being mixed with other scrap flows and ensuring that collected aluminium is recycled in Europe.

The penetration of advanced sorting technologies (e.g. X-Ray Transmission equipment) should be boosted, as they enable the increased recovery of high-purity aluminium fractions suitable for recycling in the same aluminium product, with a minimal input of primary aluminium.

3. Remove barriers in the internal market

Existing barriers (administrative and technical) to the Single Market are impeding the achievement of a circular economy and must be removed to ensure an efficient use of resources but also to foster innovation.

Objective: Secondary materials (i.e. aluminium scrap) are often classified as waste at the start of recycling value chains. It is essential that EU policy ensures this waste stream is recovered and recycled into new materials and resources. The shipment of waste across Member States needs to be made easier to avoid barriers and distortions to the Single Market. European regulation must ensure that waste - including mixed waste - that does not pose any risks to the environment can be listed as green in the Waste Shipment Regulation (WSR). For example, the shipment of waste from aluminium window profiles containing a 'thermal break' (i.e. plastic strips providing thermal insulation) does not pose any significant risk to the environment or human health. However, the classification of whether a material is hazardous or not differs from one Member State to another. In the future, more and more composites and compounds will be used. Future waste streams will therefore also be a mixture of different non-hazardous materials. Procedures for introducing new listed green codes are currently quite complex and need simplification. The clarification of definitions and the simplification of procedures for introducing new green codes should become a priority.

What needs to be done: The current revision of the Waste Shipment Regulation offers the right opportunity for EU policy makers to make substantive improvements. The administration around waste shipment needs to be simplified, be more efficient and effective and harmonised. Today, the interpretation and the implementation of existing rules vary significantly from one Member State to another. This slows down or even stops waste being shipped across borders, which generates inefficiency and distortions.

Last but not least, existing barriers to innovation should be lifted by simplifying the procedure for laboratory tests and exempting scrap destined to research and development and innovation activities.

4. Remove loopholes in the current EU legislation

Objective: Today, there is no EU 're-use & recycling' target for Construction and Demolition Waste, but only an overall 'recovery' target. The problem with the overall recovery target is that re-used or recycled waste, such as metal scrap, is counted towards targets by Members States. As well as being unfair to metals, this overall recovery target does not support the circular economy as much as it could.

What needs to be done: A 're-use and recycling' target for the whole construction and demolition waste flow should be set, as this is the only EU-regulated waste flow that does not have such a target. The European Commission and Member States can play a big role by improving the waste regulation for construction and demolition waste. By putting a true 're-use and recycling' target in place (as indicated in Directive (EU) 2018/851, the Commission shall consider the setting of preparing for re-use and recycling targets for construction and demolition waste and its material-specific fractions by the end of 2024), the circular economy of construction and demolition waste will be much better promoted.

5. Limit scrap exports

Objective: The success of our industry in driving the circular economy depends on the sufficient supply of scrap, the raw material that feeds the aluminium recycling process.

Europe should try to minimise the volume of aluminium scrap that leaves the European Union legally or illegally each year. Since 2002, the EU has been a net exporter of aluminium scrap. Around one million tonnes of scrap departs Europe for other parts of the world every year. Around 80 percent of this is exported to Asia (China, India, Pakistan, and Korea).

In 2019, China implemented a quota to control low quality scrap import but by the end of 2020, they again changed the classification of scrap to allow only the import of high-quality scrap by imposing new selective standards, among others, on purity. This affects EU recycling and hampers its circular economy objectives by encouraging the export of high-quality resource at concurrently low prices.

At the same time, more low-grade scrap is available for recycling in Europe. Low-grade scrap is more challenging to sort and recycle than high-grade scrap. However, failing to recycle low-grade scrap and exporting it outside Europe, where it is more likely to be recycled under questionable Environment, Health and Safety (EHS) conditions, is not a responsible solution.

What needs to be done: To achieve a full circular economy and meet the climate change challenges, objectives and targets, the EU needs to account for the carbon footprint of its imports and exports. Whether it is the export of scrap or the import of alloys, a level playing field must be achieved through equal implementation of similar EHS standards. This calls for extra due diligence when exporting scrap outside the EU and importing alloys from outside the EU. The EU must prescribe this approach in its regulatory instruments in a consistent way. This can be based on existing ISO standards, thresholds defined in BREFs and BATs[15] or other regulations that are fit for purpose.

In addition, we recommend regulating the sorting of scrap and imposing penalties for poor scrap sorting systems in EU countries.

Legislative measures should make exporting of scrap and products containing a lot of valuable materials (e.g. cars) less beneficial. Specifically, for End-of-Life Vehicles today there are 3-4 million cars of unknown whereabouts (but potentially being recycled outside of Europe). The revision of the ELV Directive should put in place an improved registration and deregistration system to combat illegal exports of ELVs.

[15] Best available techniques REFerence document

3.3 Incentives for circular solutions and products

Support innovation in collection, dismantling and sorting technologies

Objective: The aluminium industry should move to smarter recycling value chains with better sorting and separation of the various scrap flows in order to generate more controlled and well-defined scrap fractions. These scrap fractions should then be recycled into aluminium alloys for the same or similar type of product.

What needs to be done: digitalisation and robotics should definitively play a role to foster new end-of-life strategies and practices, with a focus on:

- Better sorting of end-of -life products according to their origins, e.g. aluminium from buildings;
- Materials identification technologies combined with targeted dismantling operations to generate higher quality of scrap flow;
- Innovative technologies for alloy identification (e.g. LIBS-Laser-Induced-Breakdown-Spectroscopy technology) and material identification in combination with robotics and digitalisation for smart sorting processes.

Stimulate innovation in melt purification and recycling-friendly alloys

Objective: A major objective for the future is to produce higher quality recycled aluminium with targeted compositions in order to enable close loop recycling, e.g. moving to a circular loop where profiles are recycled into profiles or sheets into sheets. This will require development of more recycling-friendly alloys combined with purification technologies able to remove impurities from molten aluminium.

What needs to be done: Research and development and investment into innovative purification technologies to remove impurities like iron or silicon should be intensified. The European funds for research and innovation will play a fundamental role in supporting the development of these innovative technologies and should be increased. These purification technologies should allow the production of high-quality recycled aluminium which presents the same or very similar performance as alloys made from primary aluminium. Similarly, new recycling-friendly alloy categories and compositions should be developed. They should promote and facilitate the penetration of recycled aluminium in markets which are currently dominated by primary aluminium. Too much attention is presently given to the chemical composition instead of using performance-based criteria.

Recognise the role of recycling in mitigating climate change

Support innovation in collection, dismantling and sorting technologies

Objective: The EU Circular Economy agenda will play a leading role in the EU achieving its long-term objective of becoming the first climate neutral continent by 2050. The regulatory, policy and economic framework should recognise recycling as a way to mitigate emissions in the value chain. Should increases in recycling production result in the consumption of more fuel and gas, then industrial processes should also be improved to contribute further to reducing CO_2 emissions.

The new taxonomy underlines that the manufacture of secondary aluminium (i.e. production of aluminium from recycled aluminium) is considered fully eligible as a sustainable activity. The scope of recycled aluminium should include pyrolysis[16] and incineration with recovery from bottom ashes.

What needs to be done: The revised EU ETS State Aid Guidelines for Phase 4 should combine decarbonisation targets with the principles of the circular economy. More adequate protection against uncertain CO_2 related costs would allow EU-based aluminium recyclers to further invest in recycling assets, driving additional benefits in terms of resource efficiency, energy consumption and carbon emissions. Under the current framework, the sectors eligible to receive aid are assessed at NACE[17] 4 level (i.e. 24.42 for aluminium) and listed in the State Aid guidelines. Production of secondary aluminium is thus eligible under the current rules. Each Member State can decide whether to set a budget for compensation. If so, the amount must be distributed amongst all installations in the listed NACE codes according to the guidelines.

Similarly, the revision of the EU State Aid for Environmental Protection and Energy (EEAG) for 2014-2020 should take into consideration the potential increase in recycled aluminium production. Under the current EEAG framework, chapter 3.5 outlines the conditions for Member States to grant aid when it comes to "resource efficiency and in particular aid to waste management". Recycling is not emission intensive. Aluminium recycling can continue to improve its performance by:

- Incremental improvements in process efficiency
- Evaluating alternative lower carbon fuel sources such as hydrogen or renewable electricity
- Evaluating potential for carbon capture and storage technologies

All of these would benefit from policy and research and innovation support.

[16] Pyrolysis is the thermal decomposition of materials at elevated temperatures in an inert atmosphere.

[17] NACE stands for « **N**omenclature statistique des **A**ctivités économiques dans la **C**ommunauté **E**uropéenne », the European classification system of economic activities

Stimulate demand for circular solutions

Objective: The creation of markets for circular economy products will help to accelerate the transition to the circular economy, as stressed in the "Masterplan for a Competitive Transformation of EU Energy-intensive Industries Enabling a Climate-neutral, Circular Economy by 2050"[18]. However, the environmental performance of a product does not stop when placing the product on the market. Instead, its life-cycle extends into its use phase and its treatment at the end-of-life and the successive recycling of the materials in new products. The development of a life-cycle assessment methodology that delivers an accurate and comparable analysis of the environmental impact of all materials is a necessary precondition for the development of further regulatory measures.

What needs to be done: the European Union should investigate and develop demand-and supply-side conditions that support the economic competitiveness of circular solutions. Secondly, it should monitor market penetration of circular products over time, including imports. Last but not least, it should develop harmonised measures, in particular in the design stages (design for long lifespans and multiple recycling), to promote circular products, based on a full life-cycle approach, including trade-offs between production, use-phase, end-of-life recycling and the integration of recycled materials into new products. Where possible, this should include relevant reporting systems, with metrics and indicators.

[18] European Commission, November 2019 https://ec.europa.eu/docsroom/documents/38403

04
CONCLUSIONS

The circular economy provides an opportunity to boost Europe's competitiveness by using its resources in the most efficient way, reinventing business models and creating new opportunities for jobs and growth. This will require both innovation and investment and will give Europe a growing reputation as a frontrunner in the battle against climate change and resource depletion. In addition, the knowledge obtained during this transition can be used to make other sectors more circular and enhance collaboration with other value chains.

The overall objectives of European Aluminium are to maximise collection and reduce losses, to improve sorting and pre-treatment, to remove remaining barriers to the internal market, to maximise decarbonisation potential and incentivise investment in recycling activities.

The policies that will be designed in the next five years will shape the future ways in which we produce and we consume. The European aluminium industry is at a point where 50 percent of demand could be met with post-consumer aluminium within 30 years. To achieve this, the time between now and 2030 has to be used well.

To be successful and to deliver ambitious recycling rates, work on different initiatives must begin in parallel. The industry needs to do its part, but the legislative environment at the European level should also create the right incentives for the aluminium industry to achieve its full potential contribution to the circular economy by 2030.

ABOUT EUROPEAN ALUMINIUM

European Aluminium, founded in 1981 and based in Brussels, is the voice of the aluminium industry in Europe. We actively engage with decision makers and the wider stakeholder community to promote the outstanding properties of aluminium, secure growth and optimise the contribution our metal can make to meeting Europe's sustainability challenges. Through environmental and technical expertise, economic and statistical analysis, scientific research, education and sharing of best practices, public affairs and communication activities, European Aluminium promotes the use of aluminium as a material with permanent properties that is part of the solution to achieving sustainable goals, while maintaining and improving the image of the industry, of the material and of its applications among their stakeholders. Our 80+ members include primary aluminium producers; downstream manufacturers of extruded, rolled and cast aluminium; producers of recycled aluminium and national aluminium associations are representing more than 600 plants in 30 European countries. Aluminium products are used in a wide range of markets, including automotive, transport, high-tech engineering, building, construction and packaging.

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