

GOING FULL CIRCLE

THE LIFE-CYCLE OF ALUMINIUM

Aluminium is valuable at every stage of its life-cycle, from production through to its end of use. And with even better collaboration, players from across the industry can encourage and foster best practices that ensure the best possible value is delivered at every step of the value chain.

3 ESSENTIALS TO MAKE INFINITE RECYCLING A REALITY

- 1 RECYCLING IS MORE THAN A DRIVER OF SUSTAINABILITY
- 2 WHAT REALLY MATTERS IS END-OF-LIFE RECYCLING
- 3 IMPROVING SCRAP COLLECTION AND SORTING BY WORKING TOGETHER

BEYOND RECYCLING, LIFE-CYCLE ASSESSMENT IS THE KEY CONCEPT TO MOVING FORWARD

1

RECYCLING IS MORE THAN A DRIVER OF SUSTAIN- ABILITY

▶ 5%

CREATING NEW METAL FROM RECYCLED ALUMINIUM
ONLY REQUIRES 5% OF THE ENERGY NEEDED TO PRODUCE
PRIMARY ALUMINIUM FROM BAUXITE ORE.

ALUMINIUM HAS INFINITE POSSIBILITIES.

It can be endlessly melted down and recast with no loss of its inherent properties or downgrade in material integrity. This means that an aluminium product made with scrap cannot be distinguished from a product made of virgin aluminium.

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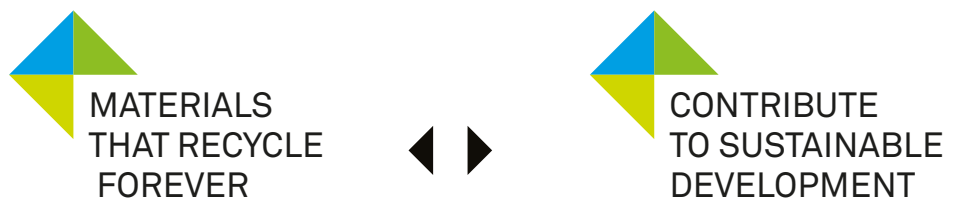
No other major industrial material has such huge differences between the environmental impacts of its two potential sources.

RECYCLING ALUMINIUM AVOIDS CO₂ EMISSIONS.

Once collected and sorted, aluminium can be recycled and reused, avoiding the use of primary metal and thus saving CO₂ emissions.

What's more, recycling is a business imperative due to aluminium's intrinsic economic value as scrap.

Recycling is essential to creating circular economy



Use rather than consume

- Permanent materials are not consumed, they are merely used.*
- Permanent materials are moved from the ground or manufactured and used in a range of applications and then “lent” to other applications after their previous use.
- They can be recycled, over and over again, without loss of properties.



* The concept of permanent materials has been developed by Metal Packaging Europe.

2

WHAT REALLY MATTERS IS END-OF-LIFE RECYCLING

▶ 75%

ALUMINIUM RECYCLING TRACK RECORD: MORE THAN 75%
OF ALUMINIUM EVER PRODUCED IS STILL IN USE.

Source: International Aluminium Institute

OF THE THREE STAGES OF THE ALUMINIUM LIFE-CYCLE, END-OF-LIFE RECYCLING IS OF UTMOST IMPORTANCE.

Recycling takes place at all three stages of the aluminium life-cycle.

→ Internal process scrap created during transformation.

→ Customer scrap produced during stamping, milling and other processes.

Recycling the scrap produced during all production stages is essential due to its cleanliness and value. As it goes throughout the complete production flow, this runaround scrap does not replace primary metal and therefore its usage does not avoid CO₂ emissions.

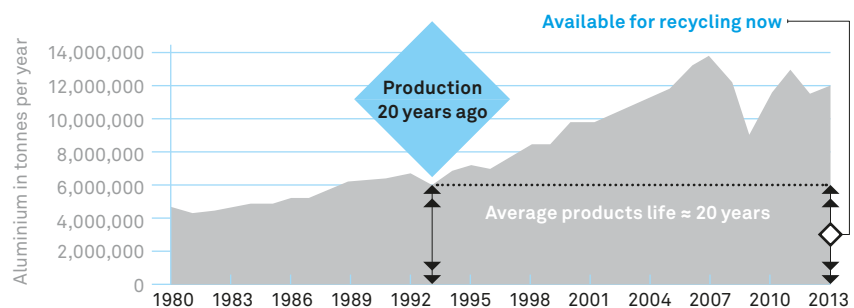
→ The end-of-life scrap from products containing aluminium such as cans or cars is a clear substitute for primary metal, especially when recycling it requires only 5% of the energy otherwise used to produce primary metal. End-of-life recycling therefore delivers clear CO₂ savings.

End-of-life recycling is the most efficient way to significantly improve the CO₂ footprint of aluminium.

RECYCLED ALUMINIUM IS OF LIMITED AVAILABILITY.

The main challenge of aluminium recycling is scrap availability. Given the long lifespan of the most dominant aluminium applications in terms of volume (such as buildings and transport vehicles), the available quantity of end-of-life aluminium scrap today is limited to what was put on the market many years ago. This, combined with consistent market growth, makes it impossible for recycling alone to feed current demand.

Increasing end-of-life recycling is the best way to enhance the overall volume of available recycled aluminium.



Source: European Aluminium

RECYCLED CONTENT CAN BE A MISLEADING CONCEPT.

There is a focus today on increasing the percentage of recycled content in the composition of products. This misconception provides an inadequate picture of aluminium recycling and may even be counterproductive to real progress in sustainability.

- Recycled content can only work if there is enough available scrap throughout all sectors. Yet the availability of recycled aluminium is limited.
- Given the limited availability of recycled aluminium, increasing the recycled content of a product is likely to be achieved by decreasing the recycled content of another product. In this case, boosting the percentage of recycled aluminium in products simply diverts the recycled metal available for other products or producers, creating no net environmental benefit.
- Recycled content potentially makes the whole recycling process less efficient by modifying existing optimized recycling streams.
- Recycled content often includes a major contribution from process scrap that brings no environmental benefits, yet this aspect is seldom mentioned, let alone highlighted!

The best way to measure progress in recycling is to measure how much recycling happens at the end of a product's life.

Recycled content may be a good marketing incentive for recycling paper or plastics but it is not suited to metals.

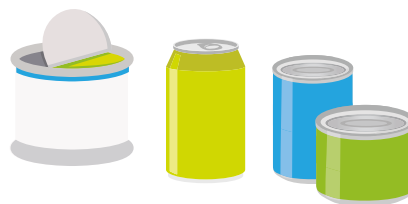
Plastic & paper



- Loses its properties after recycling.
- Low value of scrap / High cost of recycling.

Recycled content provides an incentive to recycle and is not limited by unsorted scrap availability.

Metal

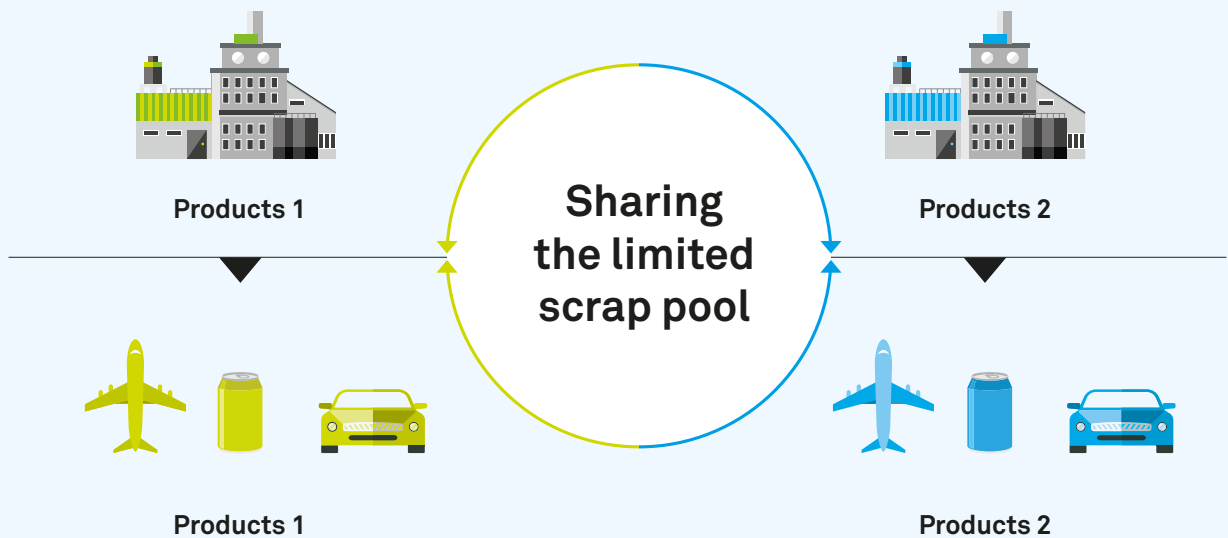


- Keeps same properties after recycling.
- Cannot be distinguished from virgin metal.
- Infinitely recyclable.
- Has value which pays for recycling.
- Has limited availability.

Recycled content is not the right incentive.

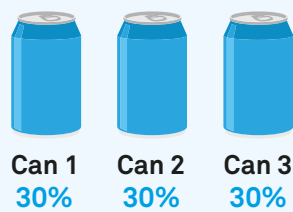
Increasing the recycled content of one product may decrease the recycled content of another...

With a limited scrap pool, increasing the recycled content of one product is often only possible if the recycled content of another product is reduced. This is why, at Constellium, we focus, through partnerships, on making the scrap pool bigger by increasing end-of-life recycling rates.



...in which case higher recycled content brings no environmental benefit.

Average recycled content for every product.



VS

Increasing the recycled content of one product doesn't change overall environmental impacts, since other products get less recycled content.



3

IMPROVING SCRAP COLLECTION AND SORTING BY WORKING TOGETHER

▶ 95%

THE END-OF-LIFE RECYCLING OF ALUMINIUM PRODUCTS IS WIDESPREAD AROUND THE GLOBE, ESPECIALLY IN THE CONSTRUCTION, AUTOMOTIVE AND TRANSPORTATION INDUSTRIES, WHICH HAVE A RECYCLING RATE OF UP TO 95%.

To improve recycling practices, the focus must shift to improving the recycled scrap collection and sorting process as a whole. This would increase the overall volume and quality of the available content, rather than concentrating on the content of individual products. At Constellium, we believe that we can only achieve this through collaboration and partnership with all relevant stakeholders, within and outside the aluminium industry.

WHY ARE COLLECTION AND SORTING A PRIORITY?

- Once collected and sorted, scrap can be easily used in one product or another.
- Good sorting enables an alloy to be recycled in the same alloy category, thus avoiding dilution or down-cycling.

Progress has been made in packaging, though there is still room for improvement in Europe and the US.

69.5%

RECYCLING RATE FOR BEVERAGE CANS IN EUROPE IN 2012⁽¹⁾

56.7%

RECYCLING RATE FOR BEVERAGE CANS IN THE US IN 2012⁽¹⁾

1. Latest available data

Recycling all the aluminium in an A320 aircraft at its end-of-life saves nearly

300t

OF CO₂ EQ./AIRCRAFT

In Europe, recycling the aluminium content of a car at its end-of-life saves nearly 1 ton of CO₂ eq./car. With 15 million cars produced in Europe each year, this means up to

15M

TONS OF CO₂ CUT ANNUALLY

CONSTELLIUM'S 4 RECYCLING PRIORITY AREAS

Improving **scrap collection rate** in collaboration with key stakeholders

Improving **sorting** through partnerships

Creating better and more **efficient closed loops**

Improving our own **recycling processes**, including the development of new and more scrap-tolerant alloys

Sustainability is an integral part of Constellium's business model. Equipped with recycling capabilities in Europe and the US, we focus on improving scrap collection and recycling at each stage of the life-cycle through our participation in various initiatives and programs.

We believe that one of the most important ways to improve the CO₂ footprint of aluminium is to improve end-of-life recycling through industry-led programs and cooperation with relevant organizations.

Constellium is extending its recycling capabilities in the US.

In January 2015, Constellium acquired the Alabama-based aluminium sheet producer Wise Metals. This acquisition adds another aluminium recycling asset to the company as Constellium's Muscle Shoals plant is already the largest recycler of used beverage containers in the world, and provides 50% of the metal used in the casting complex.

Constellium's Muscle Shoals plant recycles the equivalent of 14 billion cans back to cans.

Constellium is part of the Sustainable Committee of the American Aluminum Association and works closely with the Can Manufacturers Institute.





As a member of the Aluminium Stewardship Initiative, we are collaborating to establish and promote a standard for the responsible production and use of aluminium across the value chain, focusing on the collection and recycling of products at their end-of-life.



We are a member of the Center for Resource Recovery and Recycling, a US-based program that brings together universities and industry partners to improve recycling processes through better sorting, metal composition analysis and conditioning of scrap.



With Metal Packaging Europe we are advocating for metals to be classified as permanent materials and for the use of relevant recycling metrics.



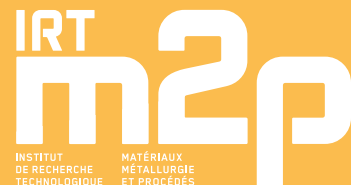
We are working together with Every Can Counts® on their communication and collection program to boost beverage can recycling rates in Europe.

We participate in programs & focus on partnerships



The Recycling Digital Machine

We were an early partner of Canibal. It provides one-of-a-kind machines that ingest and sort used beverage cans, plastic bottles and plastic cups, which are later collected and recycled. Each ton of waste collected by Canibal is the equivalent of 2.5 tons in carbon credits, with our Neuf-Brisach plant in France recycling the aluminium cans collected.



We are associated with the IRT M2P's 'LCA and Recycling' program, sharing and improving knowledge and practices in the field of end-of-life recycling – especially in the automotive sector. IRT M2P is a French technological institute for materials and processes.



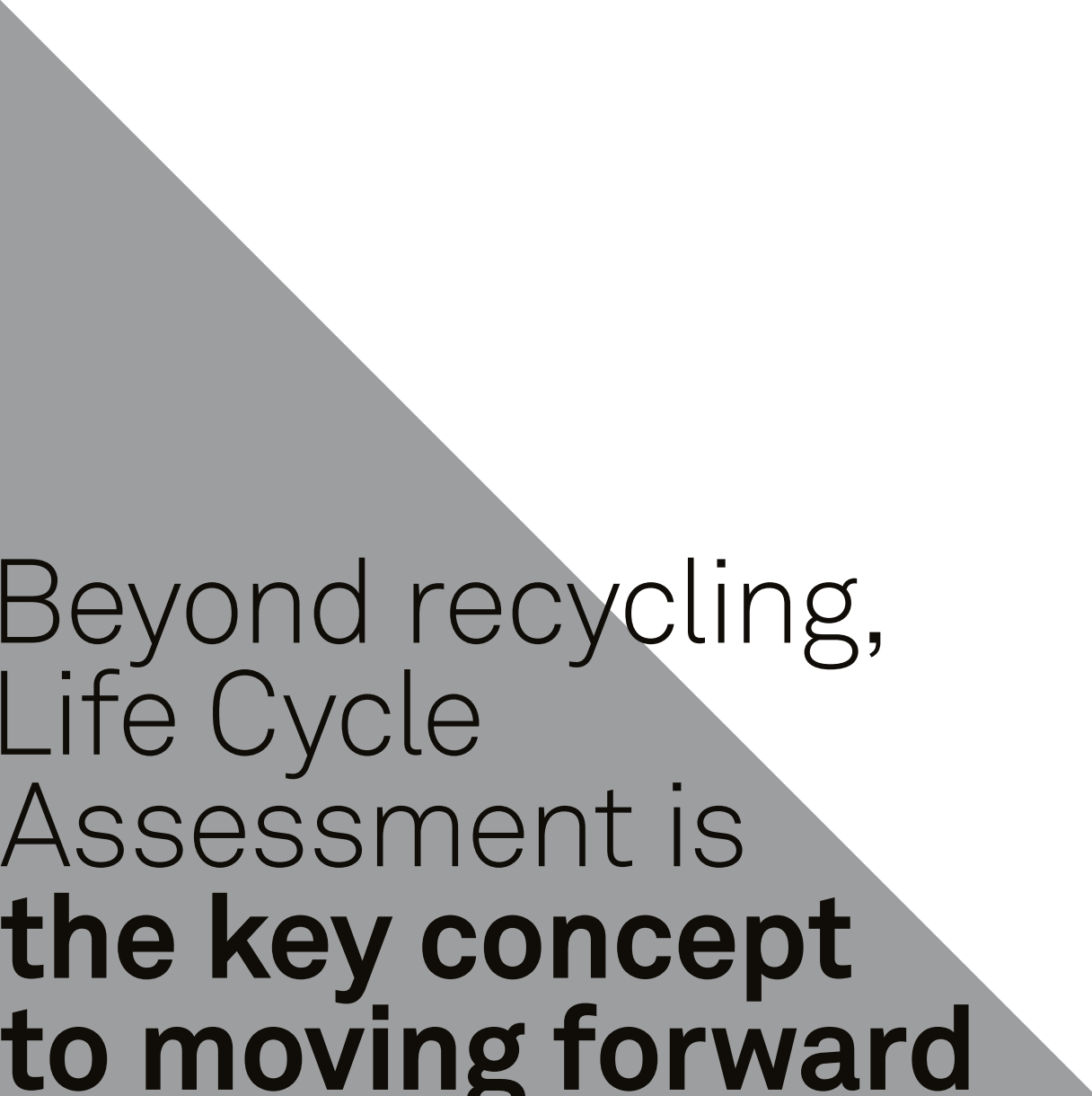
Clean Sky

We participate in the SENTRY project, an initiative taking place under the Clean Sky program and supported by the European Commission. The project aims to design recycling solutions for new aircraft fuselage structures that maximize the potential closed-loop reuse of recovered materials while minimizing environmental impacts.



EUROPEAN ALUMINIUM

As members of European Aluminium, the International Aluminium Institute and the American Aluminum Association, as well as other regional and national organizations, we work collaboratively with different stakeholders on recycling and sustainability topics.



Beyond recycling,
Life Cycle
Assessment is
**the key concept
to moving forward**

Life Cycle Assessment (LCA) is a technique to assess the environmental impacts of a given product throughout its life, from raw material extraction for the original manufacturing process through to its usage and end-of-life. This is a vital tool for mapping the upstream impacts and downstream benefits of our products, helping to identify where environmental improvements can be made at various stages of the product life-cycle.

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LCA is key to evaluating the environmental impact of aluminium products.

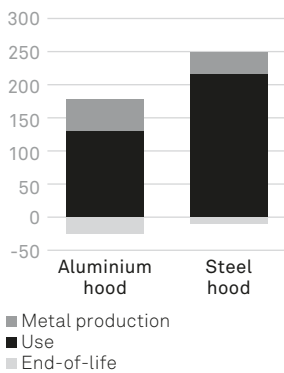


LIFE CYCLE ASSESMENT (LCA) STUDIES PERFORMED ON ALUMINIUM CANS AND CAR HOODS

We performed third-party-verified LCA studies on two key products – a beverage can model and a car hood model. This followed the introduction of sustainability checks on every new product or process as part of our innovation process in 2013.

Aluminium vs steel

(kg CO₂eq.)

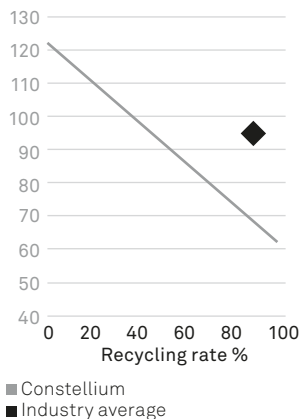


Automobile hoods

A third-party critical review led by Quantis, using real manufacturing data from plant processes and metal supply, showed that the proposed aluminium hood had significantly lower greenhouse gas (GHG) emissions than its steel alternative. More specifically, the LCA found the GHG impacts of the aluminium hood (156 kg CO₂eq.) based on our materials to be 37% lower than for steel (247 kg CO₂eq.). While the impacts associated with the upstream aluminium processes were higher, the overall impacts of the aluminium hood were lower over the entire life-cycle. This can be mainly attributed to aluminium's combination of strength and lightness, which achieves major weight savings and therefore lower fuel consumption during use. Efficient recycling also helps recover a significant amount of the initial investment.

Aluminium beverage can

(g CO₂eq./can)



Aluminium beverage cans

Using real manufacturing data we proved that an average recycling rate of 69.5% yields a carbon footprint of 80 g CO₂eq. for cans produced with our metal⁽¹⁾. This is favorable compared to the European average of 94 g CO₂eq. Based on a recycling rate of 90%, which is representative of many European countries, this figure further reduces CO₂eq. per can⁽²⁾ to 67 g. These results highlight the vital importance of increasing end-of-life recycling rates to improve the industry's sustainability, and confirm Constellium's strong position relative to competitors.

1. 69.5% is the EU+EFTA average recycling rate for 2012 (most recently published).
2. Germany, Belgium, Luxembourg, Sweden, Norway, Finland and Switzerland all perform at 90% or higher recycling rates, according to the most recent data currently available (2012) – press release from European Aluminium, March 16, 2015.

Infinite Possibilities

We are Constellium.

WE ARE [A GLOBAL LEADER](#)
IN ALUMINIUM SOLUTIONS WHOSE
BUSINESS IS TO [MATERIALIZE TODAY'S
AND TOMORROW'S IDEAS.](#)

FOR US, ALUMINIUM IS MORE
THAN A METAL.

IT IS PART OF THE SOLUTION FOR
TOMORROW'S LIGHTER, FASTER
ECONOMY. [ABUNDANT, ENDLESSLY
RECYCLABLE AND REUSABLE,](#)
ALUMINIUM'S UNIQUE PROPERTIES
MEAN THAT, [TOGETHER WITH OUR
PARTNERS,](#)

**WE CAN SHAPE A FUTURE
OF INFINITE POSSIBILITIES.**



Constellium Headquarters

Tupolevlaan 41-61
1119 NW, Schiphol-Rijk
The Netherlands
Phone: +31 20 654 9780

Constellium Corporate Offices

830 Third Avenue, 9th floor
New York, NY 10022
United States

Washington Plaza
40-44, rue Washington
75008 Paris
France

Max Hoegger-Strasse 6
8048 Zurich
Switzerland

www.constellium.com



Coordination: Corporate Communications
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