POSITION PAPER ON PCR ALUMINIUM

AS OF 01/03/2022

RECYCLING MATERIAL, PCR, PIR – AN INTRODUCTION TO ALUMINIUM RECYCLING

Closed loops are a key building block for a sustainable economy. In addition to increasing the recycling rate, this also includes the use of recycling material for new products. At present, however, a closed product cycle from tube to tube or can to can is frequently presented as the sole benchmark for aluminium packaging. At the same time, material loops often offer considerable environmental advantages in comparison with product cycles (GDA, 2021).

As we see ourselves as honest educators and pioneers for genuine sustainability at LINHARDT, we would like to use this new position paper to initiate a debate on the purpose of what we consider to be the excessively one-sided interpretation of packaging-to-packaging PCR aluminium.

To this end, it is necessary to start by determining and delimiting the terms of PCR aluminium, PIR aluminium, aluminium recycling material and virgin aluminium, which are often interpreted differently by one manufacturer or association to the next. The basis for this is the DIN EN ISO 14021 standard.

Post-consumer recycled aluminium, or **PCR aluminium** for short, is manufactured through the recycling of post-consumer aluminium scrap, also known as waste after use. According to the definition of DIN EN ISO 14021, post-consumer scrap is material which can no longer be used for its intended purpose subsequent to its actual use (cf. **end-of-life scrap, EoL scrap**). In this respect it is also irrelevant as to whether the scrap used for this purpose comes from households or from commercial, industrial and/or institutional use. PCR aluminium can be extracted from packaging, but also from other aluminium products.

Post-industrial recycled aluminium, or **PIR aluminium** for short, is not explicitly defined in the standard. **Pre-consumer material**, or waste before use, is a similar construct. According to DIN EN ISO 14021, this includes scrap which is produced when processing aluminium into semi-finished products or when manufacturing aluminium products, and which cannot be reused in the same process. It includes offcuts from pressing or rolling processes, strips, chips, production residues and production rejects, for instance. Foundry scrap, for example, is not considered to be recycling material, as it can be reintroduced directly into the smelting process.

Aluminium recycling material includes both post-consumer and pre-consumer material. **Virgin aluminium**, also known as **primary aluminium**, in contrast, refers to aluminium which is obtained directly from aluminium oxide without any share of aluminium recycling material.

POSITION PAPER ON PCR ALUMINIUM

AS OF 01/03/2022

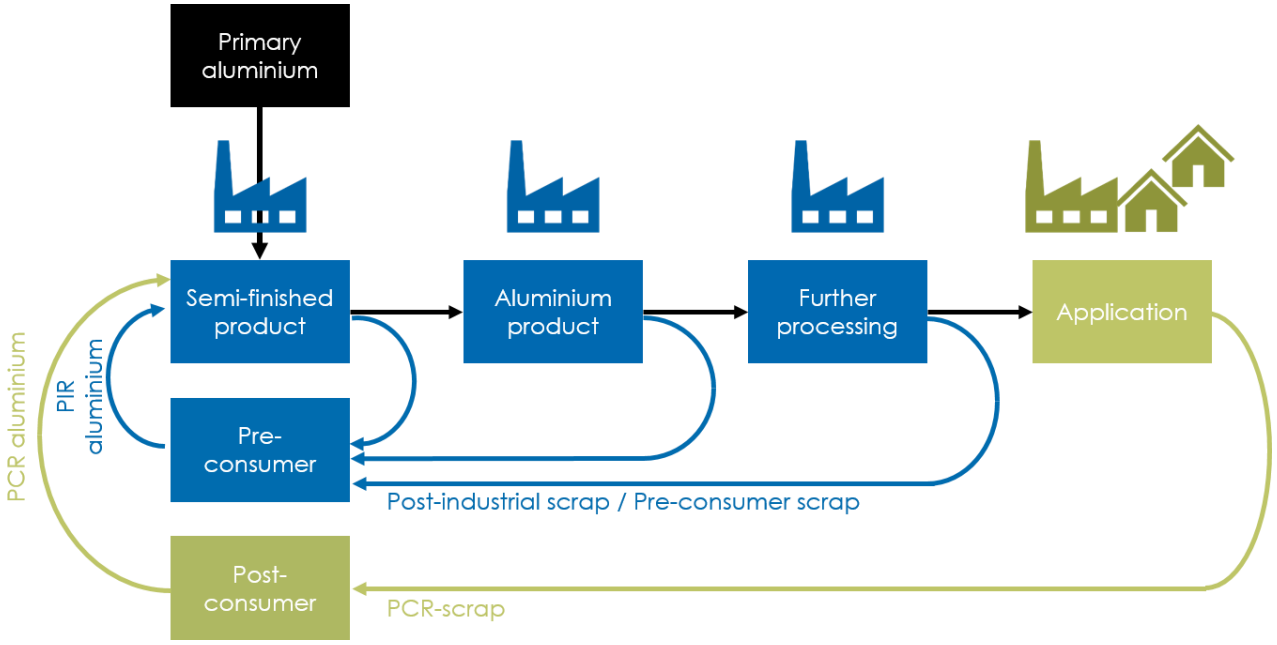

Figure 1: Diagram of PCR and pre-consumer cycles, own presentation on the basis of GDA (2021)

PRODUCT CYCLES VS. MATERIAL LOOPS

In the last position paper of March 2020 concerning the subject of PCR aluminium, we explained why PCR aluminium from closed product cycles (e.g. tube-to-tube) does not constitute a sustainable solution, either from our perspective or that of many trade associations. At first glance, the fact that we now offer packaging which is made from recycled aluminium scrap may seem contradictory. While we continue to be clearly opposed to product cycles which use "classic" PCR aluminium from recycled packaging for reasons of sustainability, we are very positive about the creation of closed material loops and the associated use of PCR aluminium from other sources.

Material loops, for example, are created by recycling end-of-life aluminium scrap (referred to hereinafter as EoL scrap), and make an important contribution to a sustainable circular economy. In the following, we will briefly explain the difference between product and material loops in aluminium packaging, and why here at LINHARDT, we are committed to closed material loops.

In both approaches, the slugs are produced from recycled aluminium scrap, thereby eliminating the more energy-intensive extraction of primary aluminium. The recycling of aluminium only consumes a fraction of the energy required for the initial extraction, and significantly reduces CO_2 emissions. In a cradle-to-gate perspective, aluminium recycling

consumes just 5% of the energy in comparison with primary aluminium. The recycling of aluminium packaging is therefore essential from an environmental point of view.

Today, more than 90% of aluminium packaging is already recycled in Germany (DAVR, 2020). This also results in new packaging, albeit mainly in other high-value goods with long product life cycles, such as window frames or automotive components. In fact, 75% of all aluminium to have been produced in the past is still in use today. The long-term attachment to aluminium and the increasing demand for this sustainable raw material mean that, according to various estimates, only around 25% of the global demand for aluminium can currently be met with recycled aluminium. Therefore, to be able to meet this demand, it is necessary to cover at least 75% of the demand for aluminium with primary aluminium.

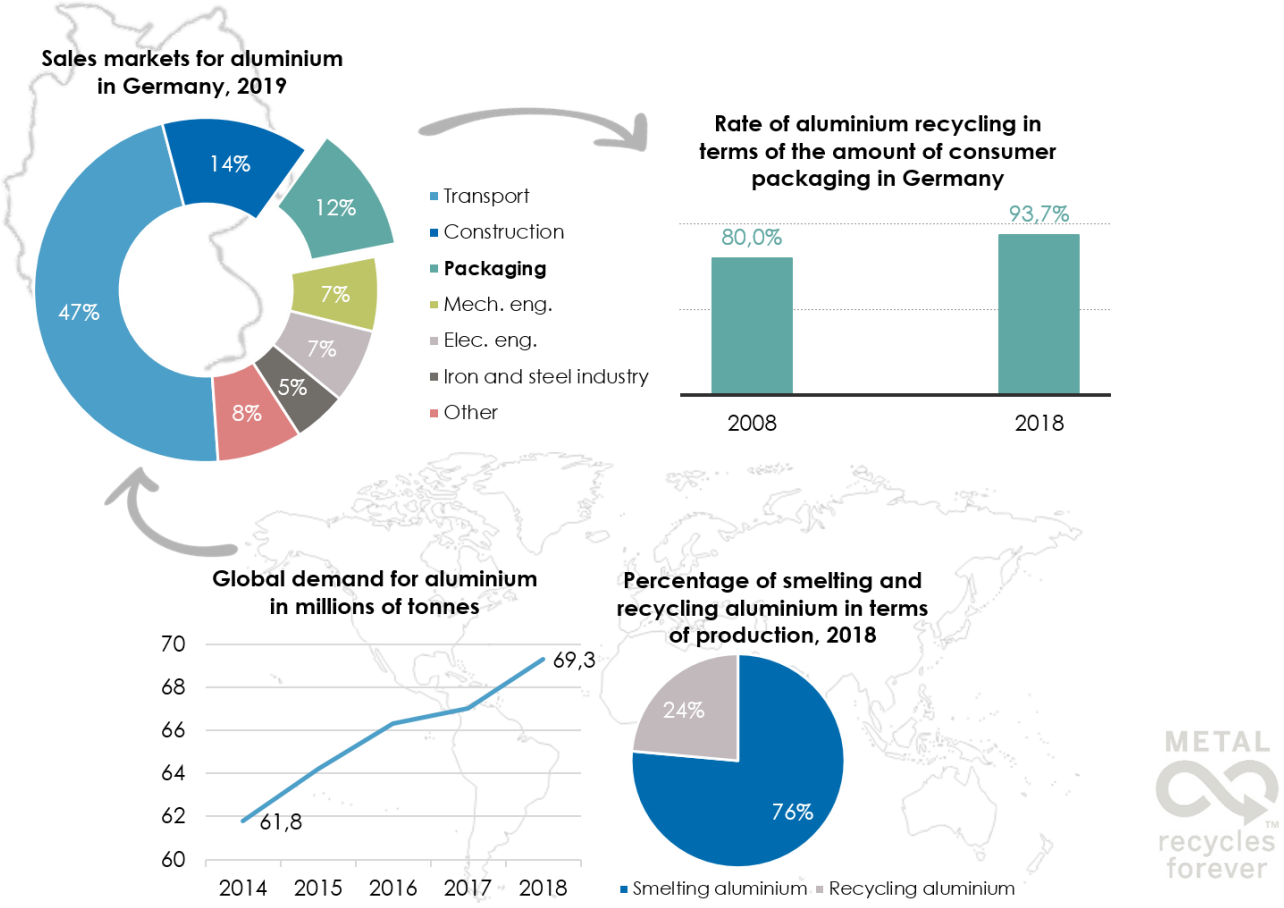

Figure 2: Overview of the aluminium market, own presentation on the basis of GDA (2019; 2018; 2018) and GVM (2020)

At roughly 12 per cent, packaging materials only account for a small proportion of the total demand for aluminium, although they have very high requirements in terms of purity. To manufacture tubes, for example, aluminium with a degree of purity which is greater than 99%

is required. Only very few products, such as packaging (aluminium foil, tube and can scrap), or lithographic plates and cable wires, have such a high aluminium content. This means that sources of scrap with a sufficiently high degree of purity are limited. At the same time, packaging scrap is only available in extremely limited quantities due to its low share in terms of the use of aluminium.

In addition, used packaging is collected in the yellow refuse sack or at various recycling centres throughout Germany, mostly on a decentralised basis. In contrast to cable scrap or lithographic plates, the **packaging which is fed into the recycling process** must therefore be **collected and sorted** by all the decentralised waste storage locations first, before being **freed from content residues, paints, varnishes and other impurities**, which is a labour-intensive process. This results in a considerable **logistical and technological workload.** By using **end-of-life PCR scrap** from other sources, such as cable wires and printing plates**,** this additional workload can be significantly reduced.

Moreover, the availability of raw materials for this scrap is high compared with packaging scrap, which means that the **supplies are reliable**. The origin of the aluminium is traceable, which ensures a **transparent supply chain** in terms of responsible **corporate social responsibility**.

Although aluminium scrap from industrial end-users has never generally been used directly by private end-users, it has been used to supply end-users, and is explicitly considered PCR material according to the DIN standard. From an environmental perspective, EoL scrap is also a waste product whose recycling benefits the environment.

The use of PCR aluminium from household waste collections makes more sense in other areas, which have less stringent requirements in terms of the degree of purity and therefore the cleaning of the scrap, and already takes place in view of the high recycling rates.

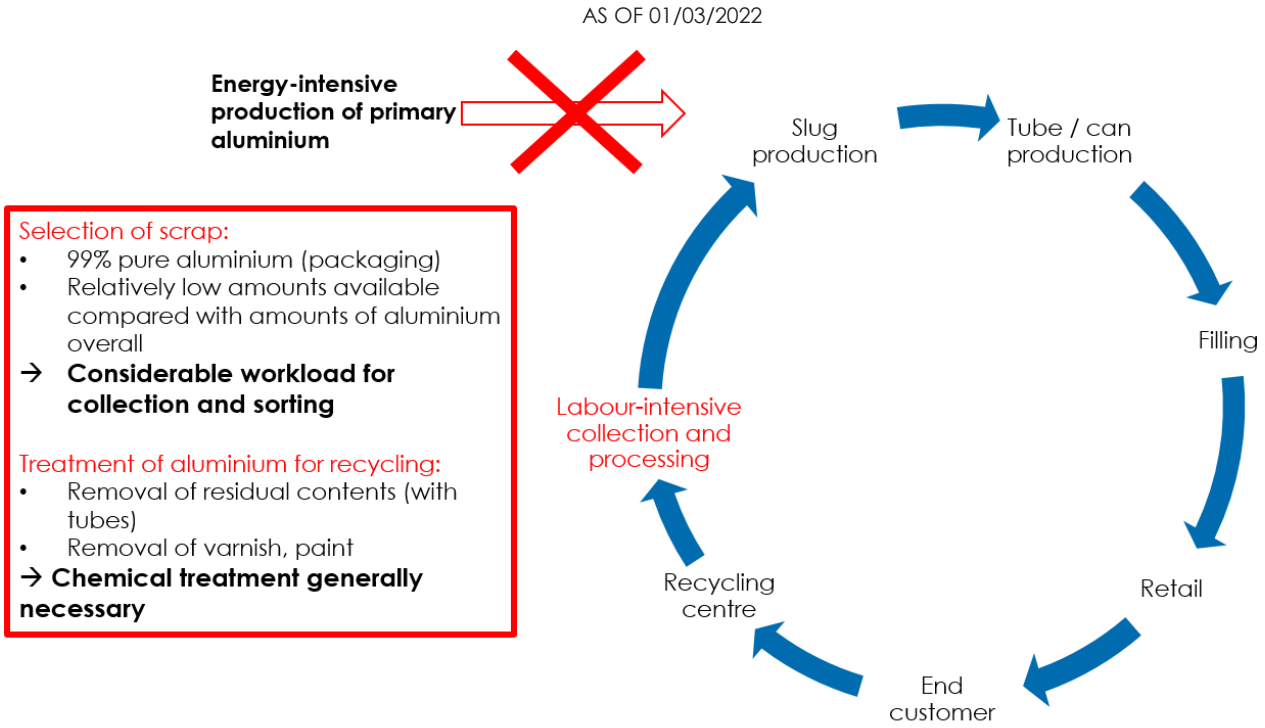

Figure 3: Example illustration of product cycle, own illustration on the basis of GDA CarboTech Study 2021 (Recyclingportal, 2021)

In the case of aerosol cans, the environmental differences between the product cycle and the material loop have already been scientifically investigated. A study completed by the Swiss research institute CarboTech in 2021 on behalf of the Gesamtverband der Aluminiumindustrie *(General Association of the Aluminium Industry)* concluded that a closed can-to-can loop for aluminium aerosol cans brings no environmental or economic benefits (Recyclingportal, 2021). As tube production is characterised by similar requirements regarding the raw materials as well as the manufacturing and recycling processes, most of the factors mentioned above are very likely to apply to PCR tubes as well.

For these reasons, LINHARDT has decided to use PCR aluminium which primarily originates from end-of-life products such as lithographic plates and cable wires.

POSITION PAPER ON PCR ALUMINIUM

AS OF 01/03/2022

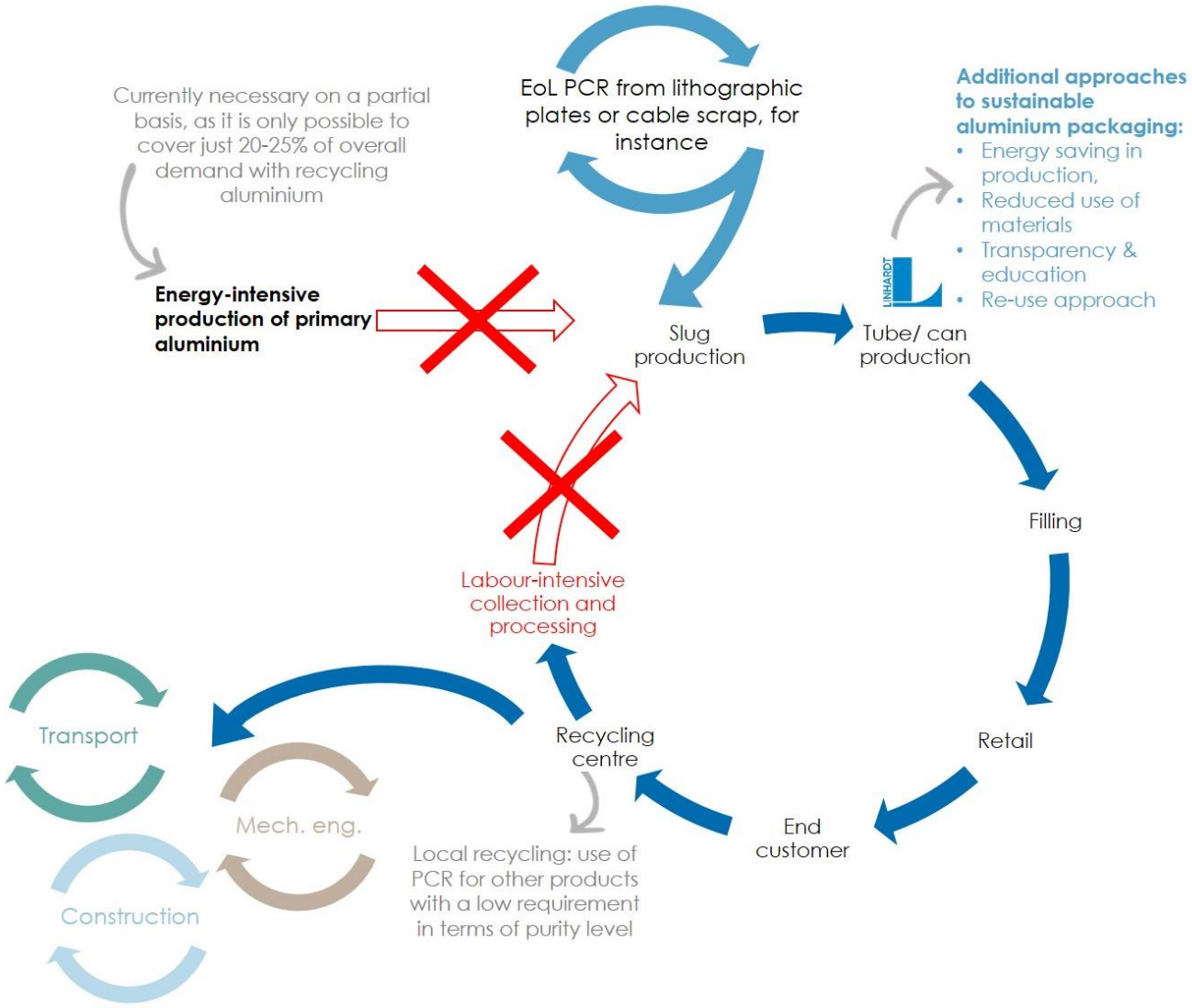

Figure 4: Example presentation of the LINHARDT PCR aluminium solution, own presentation

LINHARDT END-OF-LIFE PCR-ALUMINIUM

Environmental considerations and transparency were also our priority when selecting our slug supplier.

The sources of EoL scrap are closer to the slug manufacturer, thereby reducing transport emissions.

We also save energy during the slug production process itself. As a general rule, the scrap is first melted down at a re-smelter and cast into ingots. These are, in turn, delivered to the slug manufacturer, where they are melted down again. Our slug manufacturer, in contrast, is able to melt down the scrap directly on its premises and to subsequently cast the rolled strip for the slugs from the molten aluminium straight away. This eliminates both the energy-consuming second melting process and the transport from the re-smelter to the slug producer.

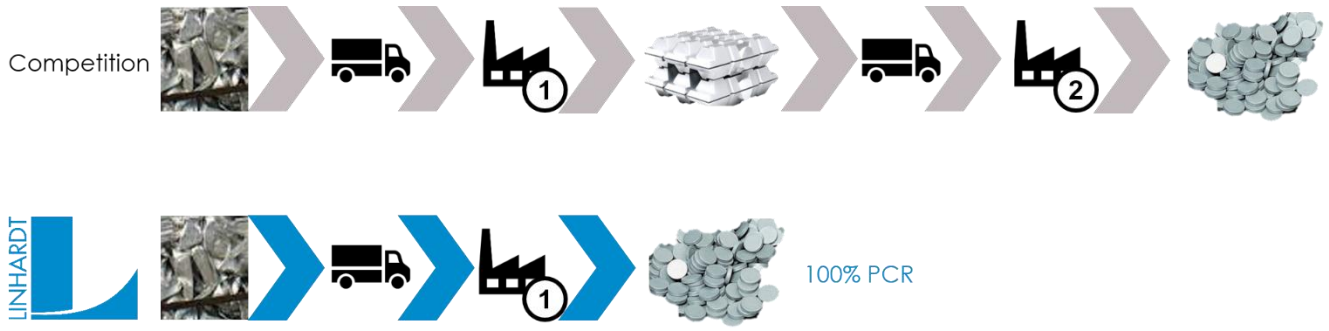

Figure 5: Production process of LINHARDT supplier, own presentation

As we attribute considerable importance to transparency at LINHARDT, customers are more than welcome to view the material flows for themselves. Audits of the LINHARDT slug suppliers are possible at any time, enabling customers to see how the scrap is converted into slugs.

In 2022, up to 10,000t of slugs can be supplied. Unlike many of our competitors, **our slugs are made from 100% PCR material**.

We recommend the completion of tests with the respective filler products, however, as we cannot definitively assess how the protective inner coating will react in combination with the PCR material.

SUSTAINABILITY AT LINHARDT: EDUCATION, TRANSPARENCY & INNOVATIVE PRODUCTS

LINHARDT is working on a tool for the creation of Life Cycle Assessments in order to present the savings potential of the respective measures and meaningfully compare product alternatives on a transparent and open basis.

Over the long term, we are pursuing the goal of CO_2-neutral production, and are on the right path due to continuous and successful savings measures. In 2020, we also succeeded in reducing the energy consumption of the LINHARDT Group by 10% compared with the base year of 2018. In total, we are currently saving some 4,500 tonnes of CO_2 each year.

POSITION PAPER ON PCR ALUMINIUM

AS OF 01/03/2022

When developing sustainable products, we follow the guiding principle REDUCE – REPLACE – RECYCLE – REUSE, as despite all of our recycling work, only around 25% of the increasing global demand for aluminium can currently be covered by recycled aluminium. To be able to meet this demand, it is therefore necessary to cover at least 75% of the demand for aluminium with primary aluminium. Given the energy-intensive initial extraction process, it is thus clear that the most sustainable approach to aluminium packaging is material avoidance. In the opinion of the GDA (*General Association of the Aluminium Industry)*, too, the focus should be on saving materials, energy and CO_2 emissions.

Here at LINHARDT, we have been working on achieving this for many years. Following the guiding principle that "the most sustainable material is the material that is not consumed", we are focusing keenly on both reducing the wall thickness of our aluminium packaging and, increasingly, the development of reusable packaging.

SUSTAINABILITY AS A JOINT TASK FOR ALL STAKEHOLDERS

Sustainable management at all levels is one of the most important challenges of our times. Consumers are now insisting on sustainability, especially when it comes to packaging. It is often the case that both our customers and consumers make decisions based on their best knowledge and conscience. Nevertheless, consumers in particular often lack the necessary knowledge to be able to categorise or understand the complex interrelationships. At first glance, producing new tubes from old tubes sounds completely sustainable to the consumer. The fact that this is not necessarily the case only becomes clear after a detailed study of the subject, however.

In the end, though, it is the consumers who decide which products to buy. Nevertheless, manufacturers and brand owners are able to influence what kind of packaging they offer their customers.

To find truly sustainable solutions, everyone involved in the product – from the raw materials and manufacturing to the packaging, filling and distribution – must carry their share of responsibility.

Here at LINHARDT, we consider it our task to educate our partners at the upstream and downstream stages of the value chain in the sense of true sustainability, as only in this way will we be able to live up to our responsibility for a future which is worth living in.

POSITION PAPER ON PCR ALUMINIUM

AS OF 01/03/2022

SUMMARY

- Packaging-to-packaging recycling loops have environmental disadvantages when compared with material loops
  → High degree of purity required: The labour-intensive collection, transport and cleaning of packaging scrap

- End-of-life aluminium scrap from cable wires and lithographic plates as a more sustainable alternative source of PCR aluminium
  - Higher delivery reliability
  - Reduced transport distances
  - Transparency of origin

- LINHARDT is able to purchase up to 10,000t of slugs per year in 2022. Our slug supplier is characterised by its exceptionally high degree of transparency and sustainability.

THE LINHARDT SOLUTION FOR SUSTAINABLE ALUMINIUM TUBES AND CANS:

REDUCE – REPLACE – RECYCLE – REUSE

Already achieved:

- Aluminium tubes made from 100% PCR (end-of-life) or PIR aluminium
- Weight-reduced aerosol cans from PCR alloy
- Aluminium bottles, cans, and rigid tubes from PCR aluminium

In development / ongoing:

- Continuous optimisation of production processes: Objective of zero CO_2 footprint
- Tool for the creation of detailed Life Cycle Assessments
- Reduction of materials through intelligent tool optimisation
- Reduction of materials through the use of special PCR alloys
- Re-use / re-fill: Development of products with multiple possible uses

Planned:

- Supply chain certification for maximum transparency

Literary sources

DAVR. (2020, November 16). Recycling von Aluminiumverpackungen steigt auf neues Rekordniveau von 93,2 %. *Deutsche Aluminium Verpackung Recycling GmbH*. Retrieved April 6, 2021, from https://www.davr.de/index.php/nachrichten/207-recycling-von-aluminiumverpackungen-steigt-auf-neues-rekordniveau-von-93,2.html#:~:text=Nach%20aktuellen%20Informationen%20der%20Gesellschaft,nun%20bei%2093%2C2%20Prozent.

GDA. (2018). *Aluminiumbedarf weltweit.* Retrieved April 6, 2021, from aluinfo.de: https://www.aluinfo.de/bedarf-weltweit.html

GDA. (2018). *Weltweite Aluminiumproduktion.* Retrieved April 6, 2021, from aluinfo.de: http://www.aluinfo.de/produktion-weltweit.html

GDA. (2019). *Absatzmärkte.* Retrieved April 6, 2021, from aluinfo.de: http://www.aluinfo.de/absatzmaerkte.html

GDA. (2021, February 2). Geschlossener Dose-zu-Dose Recyclingkreislauf bringt keine bessere ökologische und wirtschaftliche Performance bei Aluminium-Aerosoldosen. *aluinfo.de*. Retrieved April 5, 2021, from https://www.aluinfo.de/aktuelle-meldungen/hersteller-von-aluminiumtuben-und-aerosoldosen-rechnen-erst-im-dritten-quartal-2021-mit-belebung-der-nachfrage-kopie.html

GVM. (2020). *Verpackungen gesamt. Verbrauch, Verwertung, Quoten 1991 bis 2018 (in Kilotonnen) in der Bundesrepublik Deutschland.* Retrieved April 6, 2021, from https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Abfallwirtschaft/datentabelle_verbrauch_verwertung_quoten_bf.pdf

LINHARDT GmbH & Co. KG. (2020). *Besuchsbericht Butzenlieferant.* Besuchsbericht.

Recyclingportal. (2021, February 3). *Ein geschlossener Produktkreislauf ist nicht notwendigerweise vorteilhaft.* Retrieved April 5, 2021, from recyclingportal.eu: https://recyclingportal.eu/Archive/62632