

# Environmental statement 2022

Aluminium Norf GmbH, Neuss



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## Foreword

Dear readers,

for the past 2 years, the Corona pandemic has been posing great challenges to society as a whole - and to ALUNORF as well.

Despite tougher conditions, we have so far managed together to produce our rolled strips and supply our customers - something that is not being achieved everywhere at the moment. We are proud of this.

But we are also looking to the future, which holds no fewer challenges. To achieve this, it is crucial to stay on course and focus on our change process „ALUNORF 2024“.

Our mission: „We make our partners successful - through our success!“. This also includes continuously improving ourselves in terms of sustainability. As the largest aluminium remelt and rolling mill plant in the world, we want to lead the way here and have set ourselves ambitious goals. We want to noticeably reduce carbon dioxide (CO<sub>2</sub>) emissions at our site and together with our partners throughout the supply chain. By 2026, the CO<sub>2</sub> footprint of our aluminium strips is to be reduced by 30% compared to 2015.

### Sustainability is our mission

Aluminium is an indispensable material for the future – whether for lightweight packaging and car parts, for battery foil, wind turbines or photovoltaic systems. Without aluminium, energy and the mobility revolution cannot be achieved. It is important that the aluminium we need is produced to the highest standard – qualitatively, ecologically and socially. That is what we do here at ALUNORF.

We do this by constantly improving our processes, focusing on innovations and investing in new technologies, as well as constantly increasing our recycling rate..

### What we do concretely

In order to anchor the topic of sustainability in our corporate strategy and to emphasise its special significance for our actions, we have made the „ecological footprint“ one of our five strategic core areas, alongside



ALUNORF 2024 – Our Strategy

„employee focus“, „customer orientation“, „production performance“ and „cost efficiency“.

The new department „Sustainability and Environment“ has given the topic a firm organisational foundation. With a view to decarbonising ALUNORF, new ways of supplying energy and alternatives to gas as an energy source for our stoves are being developed here – in close cooperation with stove manufacturers, universities and research institutes.

Our biggest lever for our ecological footprint is recycling: the more recycled material we use, the more resource-efficient the product. Therefore, we strongly focus on measures to increase the share of recycled material in our bars and strips. Milestones on this path are the current projects to automate the charging process in the remelt area (BIS), the new recycling furnace 3 and the new soaking pits 21 and 22.

These are all important steps to position ALUNORF responsibly and competitively for the future, so that it can also offer good and secure jobs at the site for future generations.

With the Environmental Statement 2022, our longstanding participation in EMAS is once again confirmed. Our environmental and safety certificate and that of the Aluminium Stewardship Initiative have also been renewed. These are all central building blocks and proof of our active sustainability strategy.

# Big aluminium coils – that’s what we make.....

## What our customers need our coils for

We make hot- and cold-rolled aluminum strip of high quality. Our products are shipped as rolled up “coils” to our shareholders Novelis and Speira and their customers. In their plants they make products or semifinished products for the packaging, printing and automotive industries and for the transport and construction sector.

To be more specific: Our strip is processed into facade and roof panels, body parts for automotive applications, meal trays, beverage cans, can lids and screw caps, aluminium foil and litho printing sheets. Potential for further growth lies in particular in the automotive industry.

## ALUNORF

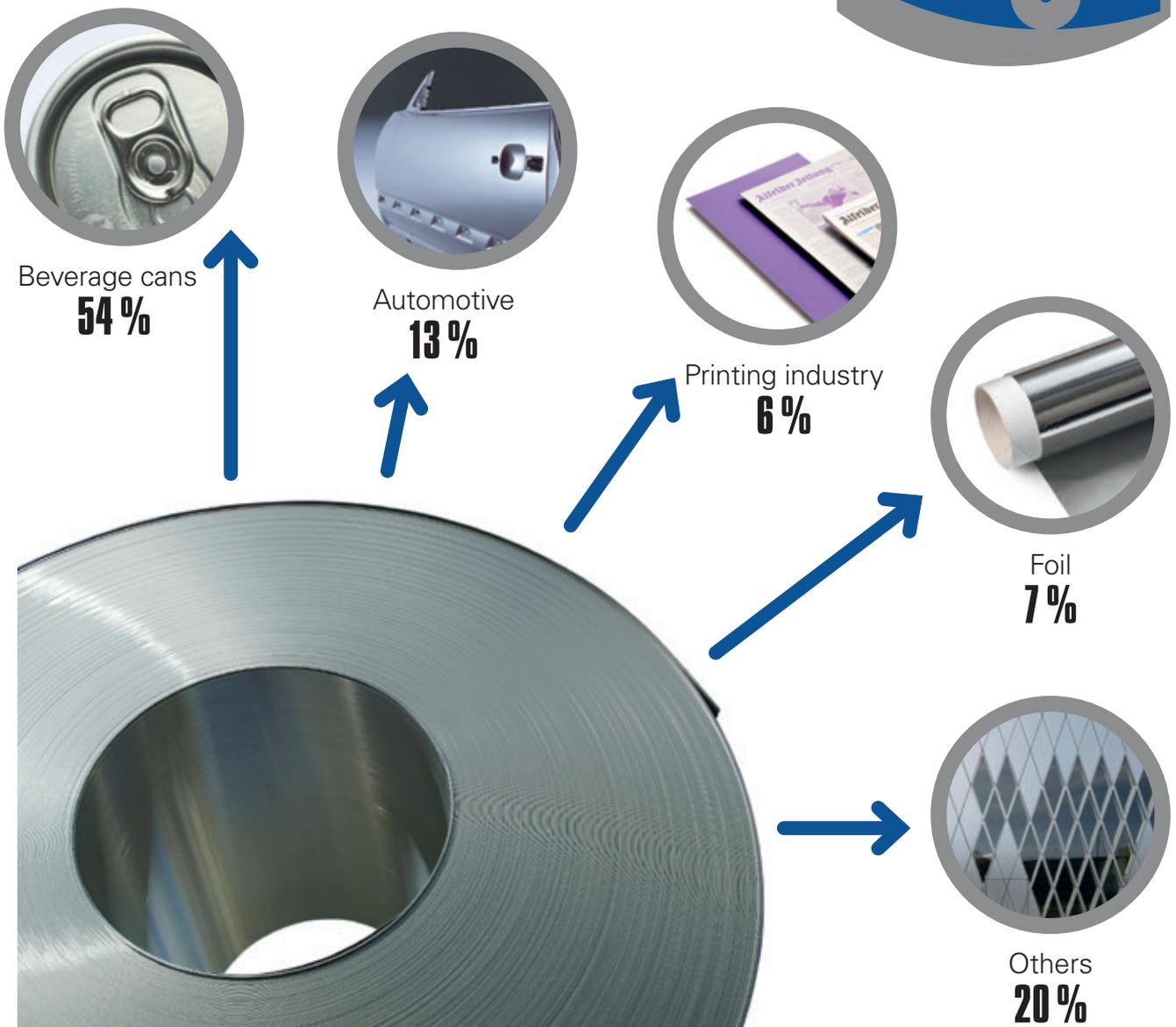
### FACTS & FIGURES

170 000 aluminium coils per year

Weight per coil:  
6 to 24 tonnes

1.5 million tonnes per year

ALUNORF is the world’s biggest aluminium rolling and casting facility.



## ALUNORF lies in the south of Neuss

...over 50 years

Aluminium Norf GmbH (ALUNORF) was founded in 1965 by Canadian Aluminium Limited, Montreal (Alcan) and VAW Vereinigte Aluminiumwerke AG, Bonn as a rolling plant for the growing aluminium market in Europe. Production with the new facilities started in 1967. Since then the plant has become bigger and bigger to meet demands of the growing aluminium market.

The largest expansion to date (called Norf 2) was decided by our partners in 1990. In 1995 the second hot mill, the tandem cold mill 5 and the first melting / casting furnaces with a capacity of 120 t started production nearly doubling capacities.

In 2002 VAW was taken over by the Norwegian Norsk Hydro ASA, Oslo. In 2005 Alcan spun off their rolling activities including our share in Novelis Inc., Atlanta. In 2021, the US company KPS Capital Partners („KPS“) took over Hydro Aluminium Rolled Products. Today, Speira GmbH (Speira) and Novelis Deutschland GmbH (Novelis) are each 50 percent shareholders (partners) of Aluminium Norf GmbH.

Both shareholders are our sole customers as our aluminium band is finished and sold exclusively by Speira and Novelis.



Today about 2 250 people work at ALUNORF making it the most important employer in Neuss.

At the time of the plant's foundation the industrial area Stüttgen was part of the community Norf. From this local connection stems the logo and short name ALUNORF.

ALUNORF's production site takes some 58 hectares. There of 28 hectares are covered by buildings; another 18 hectares are used for traffic ways and storage areas.



### Location Neuss-Stüttgen

The plant is connected to A46 and A57 motorways by the main road B9 and receives its material by rail and from the Rhine ports at Stürzelberg and Neuss. Thus a major part of supplies and coils is transported in an environmental friendly manner by ship and rail. Since 2015 ALUNORF has two other plant accesses for trucks in order to avoid traffic congestion on public roads.

# Environmental chronicle

Highlights from more than 50 years of environmental protection

1974



ALUNORF develops the patented Airpure waste gas cleaning system at the cold mills

1996



Waste heat recovery with a new type of regenerator burners at melting furnace 13 (Modernisation 2019)

1997



First Environmental statement

1997



Demulsifying plant for chemical-free separation of oil and water

1998/1999



Waste heat recovery from melting furnaces and district heat supply to Allerheiligen

2009

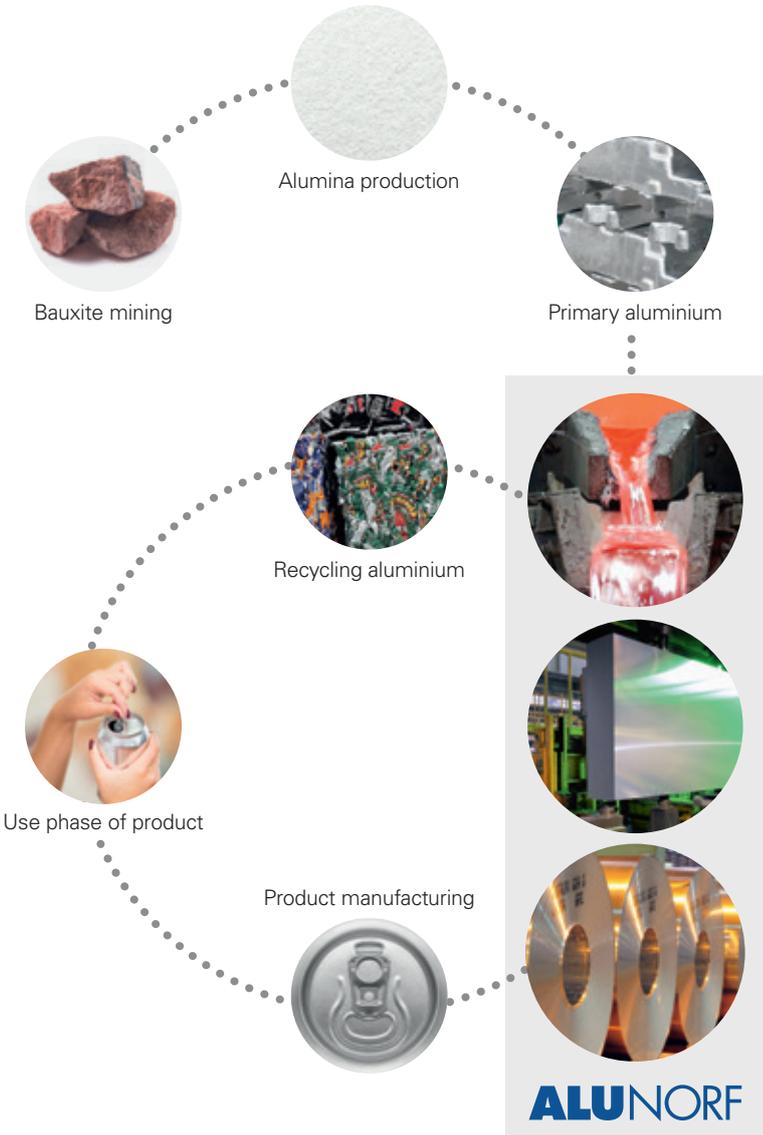


Recycling center to melt soiled aluminium (Project 3rd furnace, start of operation 2023)

## Life cycle of Aluminium

The base material for aluminium production is bauxite. The metal is extracted from bauxite ore in a two-stage process.

Under pressure and heat aluminium hydroxide is generated. This aluminium hydroxide is then heated to gain aluminium oxide (alumina) which is the starting product for the second process step: the electrolysis. In this process liquid aluminium is gained from alumina and then cast e. g. into ingots.



**FACTS & FIGURES**

ALUNORF gets the entire metal it needs from its shareholders for conversion and returns rolled coils to them. In the environmental management system ALUNORF is only responsible for the production steps at the Neuss site.

## Aluminium in the cycle

The economic value of aluminium has at all times made the cycle of metal processing, usage and metal recycling profitable. A real win-win situation. The production of primary aluminium is energy-intensive (approx. 14 kWh of electricity per kilogram). Remelting aluminium (recycling), on the other hand, requires only about 5 per cent of the energy originally used (about 0.7 kWh

of electricity and natural gas per kilogram). Aluminium with its specific properties is a sustainable material par excellence, essential for the future. ALUNORF is part of the cycle. Every year we process around 400 000 t/a of solid aluminium scrap. In addition, we receive almost 90 000 t/a of liquid aluminium – with upward trend.



Transport in big crucibles holding approx. 15 t of liquid Aluminium.

**FACTS & FIGURES**

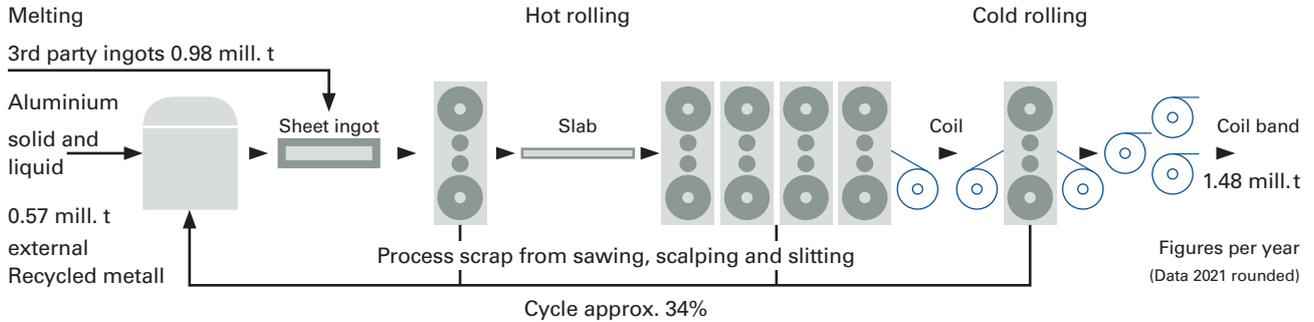
Liquid metal is transported in big crucibles. The aluminium in there has a temperature of approx. 750 °C. It is directly charged into the melting process to avoid a second cooling down and melting. A cycle like this only works with regional supply chains.

# How coils are made

On melting and casting, rolling and slitting...

## ALUNORF-Produktion

From sheet ingots to aluminium coils



ALUNORF has three major production units:

- Remelt incl. Recycling center
- Hot mill unit
- Cold mill / slitting unit

The flow chart above shows the in-house production and recycling flow from sawing, scalping and slitting back into the production process.

At the beginning of our production so-called sheet ingots are cast in our remelt resp. supplied from other smelters or recycling facilities by ship and/or train.

The production of ALUNORF ingots comprises the melting of scrap, the casting of still untreated ingots and the sawing and surface scalping to become sheet ingots.

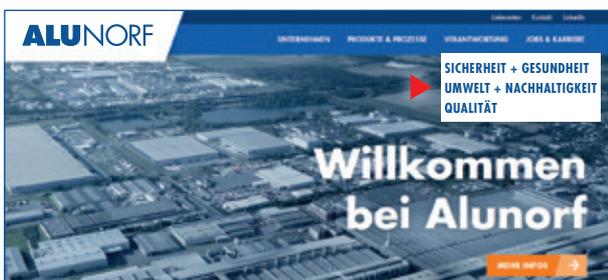
Next comes hot rolling. To this purpose the sheet ingots are heated up in gas-fired preheating furnaces to approx. 500°C.

There are two steps in the hot rolling process: The breakdown mill makes a long and thick plate (called a slab) which is further rolled down in the finishing mill to become a band (wound up as coil).

After intermediate cooling the last manufacturing step is cold rolling. The band is reduced in up to six passes to a thickness of 0.2 - 1.5 mm. It is then trimmed acc. to customers' specifications and protected for transport.



Information on ALUNORF, aluminium and the environment can also be found on the Internet



Waste gas cleaning Recycling-Center

## Remelt

Remelt uses ALUNORF process scrap, e. g. sawn heads and tails of sheet ingots, scalper chips as well as trimming and cropping scrap from the rolling units. In addition aluminium is charged as prime and also as solid and clean production scrap from third parties.

Recycled aluminium from external facilities and from ALUNORF's own recycling centre is charged into the furnaces as liquid melt. Furthermore our recycling centre can also process scrap with organic content. Alloy metals are added as needed. The recycling centre will be extended by a 3rd furnace.



Melting furnace – charging of pigs

The aluminium liquified in the melting furnaces is transferred to the casting furnaces at approx. 730°C. There it is treated with a nitrogen-chlorine-mixture, thus cleaned from contaminations.

The exhaust gases are cleaned from chloric compounds and dust (chlorine scrubber and fabric filter with lime addition; in the recycling centre lime mixture with an inorganic additive). The cooling water needed for the casting is circulated. The waste water is cleaned in two steps before being discharged into the River Rhine.

Waste heat is regenerated from the exhaust gas of the melting furnaces. Some of it is supplied to the district heating system for the residential area Allerheiligen and industrial area Tucherstrasse.

### FACTS & FIGURES

#### Main equipment of remelt:

- 13 Melting / casting furnaces
- 9 Induction melting furnaces
- 3 Recycling furnaces
- 10 Drying chamber furnaces
- 3 Waste gas cleaning units (baghouse filters)
- 13 Chlorine scrubbers
- 1 Waste water treatment plant

**Ingots:** up to 32 t / piece  
max. 9 m long · approx. 0.6 m thick



For safety reasons wet metal must be prevented from coming into contact with liquid melt during the melting process, otherwise there is a risk of explosion. Therefore externally supplied solid metal (e.g. in the pigs and saws) is dried before it is added to the melting process.

Drying takes place in chamber furnaces, which are heated with exhaust gas from the melting furnaces. This means that no fuel is required for heating. The aluminium solid metal is heated to approx. 150 °C and processed as quickly as possible.



Sawn ingots



Cast ingot – approx. 9 m long

# Hot rolling

In the hot mill area the ingots are first preheated in gas-fired furnaces of different designs to reach approx. 500°C. Then they are hot-rolled in the breakdown mill to slabs and in the finishing mill to band that is rolled up into coils. Approx. 15% of these coils are shipped without undergoing other production steps. The major part is cold-rolled after cooling down.

## FACTS & FIGURES

### Main equipment of the hot mill unit:

- 3 Saws
- 3 Scalpers / 2 edge scalpers
- 22 Soaking pit chambers
- 6 Pusher furnaces
- 2 Hot mill lines each with breakdown and finishing mill
- 4 Waste gas cleaning units
- 1 Waste water treatment plant

**Hot band:** 5 – 29 t/ Coil  
up to 2.4 km long  
approx. 2-10 mm thick



Hot mill 1 – breakdown mill

The preheating furnaces feature an integrated waste heat recovery equipment (recuperators). In order to cool and lubricate the rolls an emulsion is needed consisting of more than 90% of salt-free water and special oil components. In 2007 we banned the use of environmentally hazardous biocides. Emulsions are kept in a closed cycle and filtered to remove contaminations. The heat increase of the emulsion from the rolling process is discharged through cooling water. Also the cooling water is used several times by keeping it in a closed cycle.

The components (water and oil) of the rolling emulsion that have been vaporised by the rolling process are sucked off and recycled in a separating / exhaust air cleaning system. An oil recycling system processes floating or used oil components of the emulsion for reuse. Through distillation emulsion is separated into oil and water phases without chemicals. The old oil can be used as fuel. The aqueous phase is cleaned in two other steps.



Slab in hot mill



Hot mill 1 – finishing mill

## Cold rolling / finishing

In the cold rolling unit five cold mills further reduce the hot-rolled coils in up to six rolling passes to a gauge of 0.2 mm.

For quality reasons some coils are subject to heat treatment in the annealing furnaces. In order to avoid oxidation of the aluminium surface a protective gas (nitrogen and carbon dioxide) may be used.

After the coils have been reduced to reach their final gauge they are trimmed to customers' specifications, cut-to-length and packed for shipping. If needed the coils can be lubricated for deep-drawing.

The packed aluminium coils are shipped by rail or truck. The total shipped volume in 2021 reached around 1 500 000 tonnes (hot- and cold-rolled band).

Rolling oil fumes from the cold-rolling process are sucked off and fed into exhaust air cleaning systems. The rolling oil is recycled and used again. This idea stems from the 1970s and was developed by ALUNORF, patented as AIRPURE treatment and used worldwide today.

## FACTS & FIGURES

### Main equipment of the cold rolling/ finishing unit:

- 5 Cold mills
- 6 Slitters
- 30 Annealing furnaces
- 3 Waste gas cleaning units (AIRPURE)

**Cold band:** 6 – 24 t/ Coil  
up to 22 km long  
min. 0.2 mm thick

The rolling oil is kept in a closed cycle and contaminations filtered by adding a filter aid. As the spent filter earth contains oil it is utilised as fuel.

The heat increase of the rolling oils from the rolling process is discharged with the help of cooling water. Also the cooling water is used several times by keeping it in a closed cycle.

Used rolling oil is distilled and the cleaned oil used again. Unavoidable waste oil is used as energy or material.



Cold mill 4 – exit side

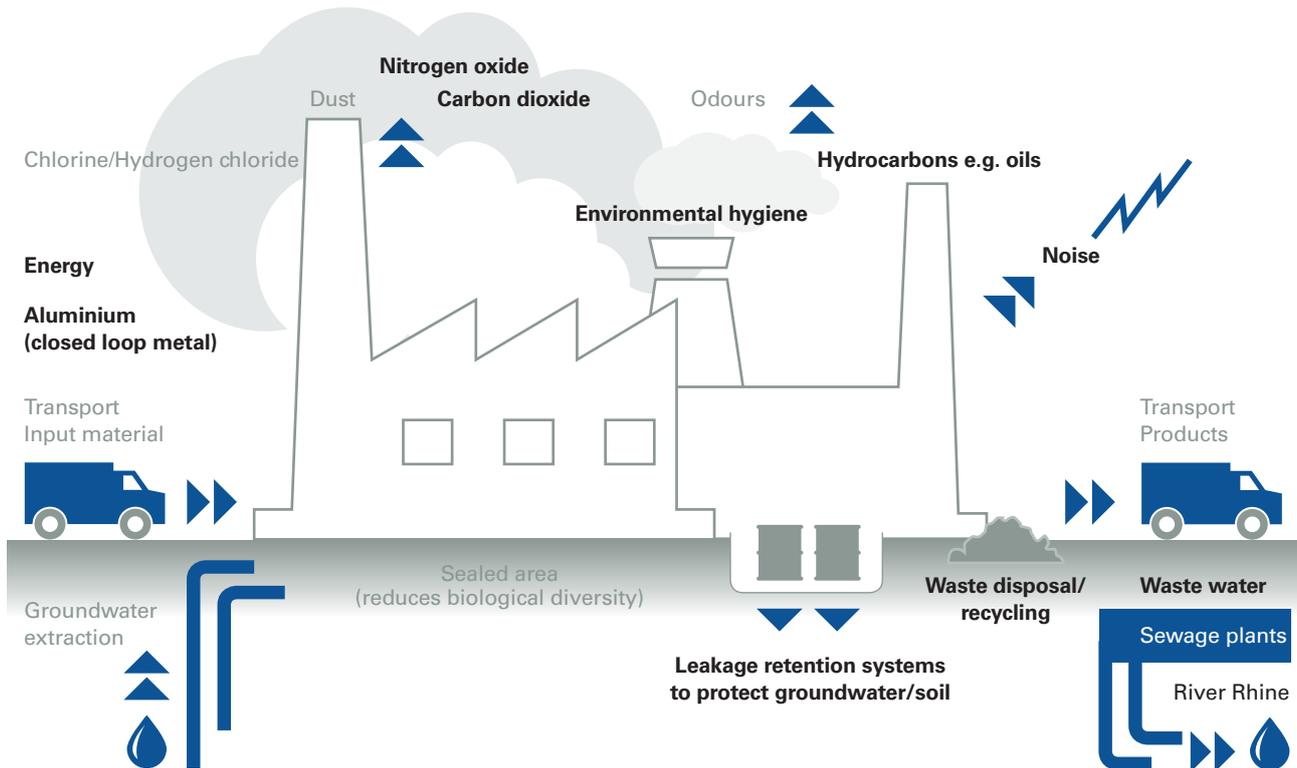


Cold mill – entry side and coil inspection



Shipping area – Coils ready for shipment

## Illustration of environmental aspects



# Impacts on the environment

## Compliance to regulations

### Machines need environmental permit

Our production lines and service facilities are subject to official permits under the Federal Emission protection Act (production equipment/auxiliary systems) and the Water Resources Act (sewage plants) as well as the Building Law (buildings, traffic ways and parking lots). Environmental aspects arising from the environmental law are shown in the picture above. The most relevant environmental impacts and issues are in black.

### Environmental relevance assessed

Currently executed or planned activities are assessed for their environmental relevance. This is done on the basis of various environmental categories, called environmental aspects. An environmental aspect such as waste or exhaust gas may have an impact on the environment or not. Impacts may be positive or negative. The environmental aspects are assessed and prioritised for our activities.

### Reliable data

Reliable base data are most important. This is one of ALUNORF's strength. We use e. g. data from the SAP system, weightings, measurements and operational information systems for material and energy input, and establish and check their reliability and plausibility with random samples. Major energy consumers are connected to an online monitoring system. The methodology how to calculate figures is plausible and traceably documented.

### Plausible assessment criteria

When assessing the relevance of environmental aspects the following criteria are applied:

- Area where environmental aspects play a role (locally, regionally, globally)
- Potential of escaped substances (e. g. greenhouse effect, acid effect etc.)
- Energy and material flow per calendar year
- Legal aspects (e. g. ban of particular substances, reduction of hazardous substances, avoidance of waste / recycling, core indicators acc. to EMAS)
- Risk for impacts on environmental
- Cost effects

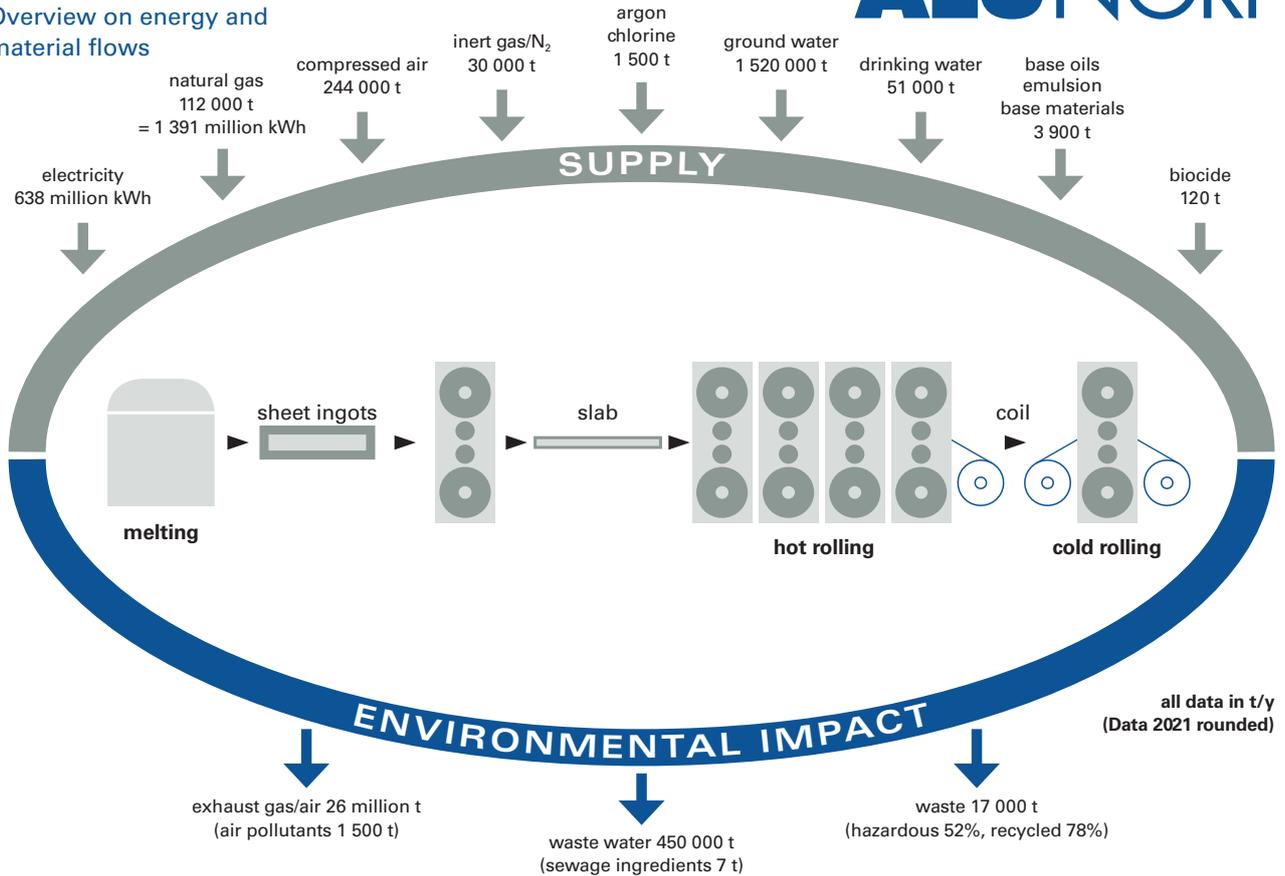
### Annually assessed

Environmental impacts are assessed annually. The core indicators stipulated by EMAS are also determined each year. Actual data for figures between 2019 and 2021 are shown in the chapter „Input-Output balance“ (see pages 38-39). The increase of energy efficiency and the re-use of aluminium have top priority.

### Sealed soil / Biological diversity

The space needed for production (sealed soil) a.o. has an impact on flora and fauna as well. 46 hectares (79 %) of our premises (58 hectares) are sealed. Related to our production volume of approx. 1.5 million t/a the impact of 0.03 m<sup>2</sup>/t is comparably low as a result of our facility layout resembling a circle.

## Overview on energy and material flows



## Energy and material supply

### Handling and storage

Our production lines need energy and a wide range of raw materials. The picture shows the annual demand in the upper and the environmental relevant materials in the lower half. The specific data of externally supplied material can be found in the input-output balance on pages 38-39. Compressed air, protective gas and nitrogen are produced on site.

### Safe handling has always priority

Natural gas, electricity and other material is needed for production. Energy supply ranks first; a reliable and safe supply is indispensable. Safe handling avoids risks for men and environment. To gather leakages from handling and storing large collection systems are in place. In-house controls and technical checks complete our safety concept.

### Preferably no hazardous substances

#### Hazardous materials, water- and soil-hazardous substances

Before use, each substance is tested for necessity, if possible we do not use any hazardous substances at all. Substances in use are checked at regular intervals on the basis of up-to-date material data sheets. We are always in contact with our suppliers and ask for the latest information. The data gained become part of hazard assessments and are the basis for the particular hazard labelling. These are included in operating instructions for our employees that we train regularly on how to proceed in case of emergencies, e. g. when oils, chlorine and carbon dioxide (extinguishing agent) have escaped.

## FACTS & FIGURES

### Main supply facilities:

- Natural gas transfer station
- High voltage transformers
- Heating boilers
- Compressed air generators
- Inert gas generator
- Ground water well
- Water treatment
- Cooling towers
- Oil and emulsion handling
- Store for materials, gas and other substances
- Safe chlorine storage

### Main environmental protection facilities:

- Exhaust gas/air purification
- Waster water treatment
- Retention basin for firefighting water and contaminated waste water
- Collection system for leakage
- Waste collection

### Safe chlorine storage

Chlorine is needed to purify liquid metal.





# What our guidelines mean for our actions

Our mission: We make our partners successful - through our success!

## Customers

Our incentive: to understand our customers best - and to meet their needs quickly, flexibly and with high quality. We are in constant exchange with our customers and develop products and processes together. Together with our customers, we contribute to the creation of indispensable and sustainable products for society from our aluminium.

## Owners

Through our commitment to excellence, we ensure continuous improvements in terms of quality, productivity, cost efficiency and sustainability. We are a driver of innovation and thus support the further development of our customers' products. In this way, we contribute to the economic success of our owners.

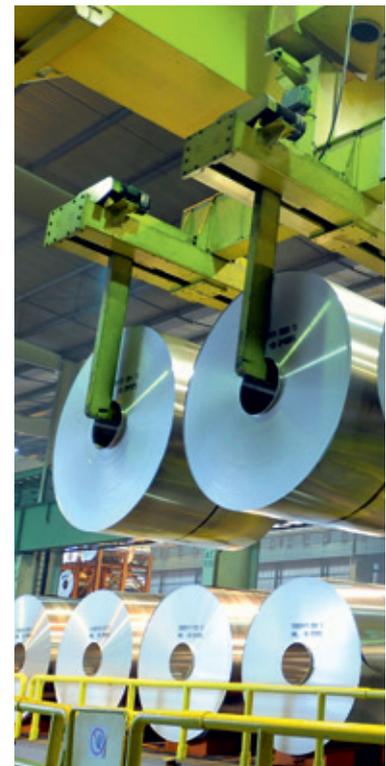
## Employees

We offer opportunities for lifelong development and learning. In this way, we contribute to the future viability of our employees, who make up the success of ALUNORF. As a modern and attractive employer, we offer our employees opportunities to shape their lives and develop their skills, as well as lifecycle-oriented forms of work.

The health of our employees is a high priority for us. We attach great importance to safe working conditions.

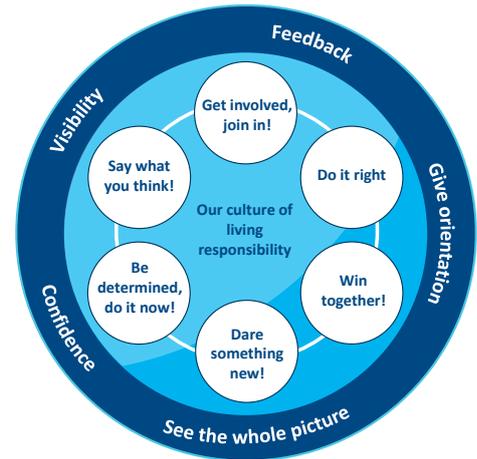
## Society

As a successful company, we strengthen the attractiveness of the region and ensure economic power. We maintain an open dialogue with neighbours, suppliers, authorities and partners. We produce semi-finished aluminium products in an environmentally friendly and legally compliant manner in the face of global competition. In doing so, we commit ourselves to the continuous improvement of sustainability through ambitious goals.



## Our vision: ALUNORF is the benchmark for excellence Aluminium is our passion.

- Efficient processes ensure that people and technology are optimally combined.
- Our culture of responsibility creates a dynamic environment for efficient, innovative and sustainable production.
- We are shapers of our future. The owners are happy to invest in our plant, thus securing our joint competitiveness.
- We are an attractive place where people can grow and drive innovation and development.
- Our partners are happy to have us. They can always rely on us



## Our mission statement: Our actions are oriented towards the focus five

Focus areas	Strategic goals
 <b>Employee focus</b>	<p>We are also the benchmark for excellence in our industry when it comes to safety: all ALUNORF employees should work safely and go home healthy. <b>Zero accidents</b> are therefore our goal. By constantly reducing our accident figures, we are getting closer to this goal.</p> <p><b>We look out for each other!</b> In the spirit of our culture of lived responsibility, we create an environment in which our employees develop a high level of motivation and strong commitment and feel connected to ALUNORF.</p> <p><b>We talk to each other!</b></p>
 <b>Customer focus</b>	<p>We ensure that our customers receive products of outstanding quality at competitive prices on time.</p> <p><b>Zero complaints</b> are our goal. <b>We all adhere to our standardised and structured processes at every step of the way!</b></p>
 <b>Ecological footprint</b>	<p>We are significantly reducing our environmental footprint. By using new technologies and increasing our process efficiency, we save energy and CO<sub>2</sub>.</p> <p><b>We all pay constant attention to the careful use of resources!</b></p>
 <b>Production performance</b>	<p>All our key plants become benchmarks of excellence by increasing plant availability, plant performance and yield. We pay attention to losses and eliminate them systematically and sustainably.</p> <p><b>We all look closely and get actively involved!</b></p>
 <b>Cost efficiency</b>	<p>We keep our costs under control so that our partners remain competitive in the market. We achieve this by meeting our sales targets and keeping our plants in basic condition. This is the basis for continuous modernisation and for securing our location</p> <p><b>We feel responsible for our facilities and equipment!</b></p>

## Responsibility for safety, health, the environment and future generations:

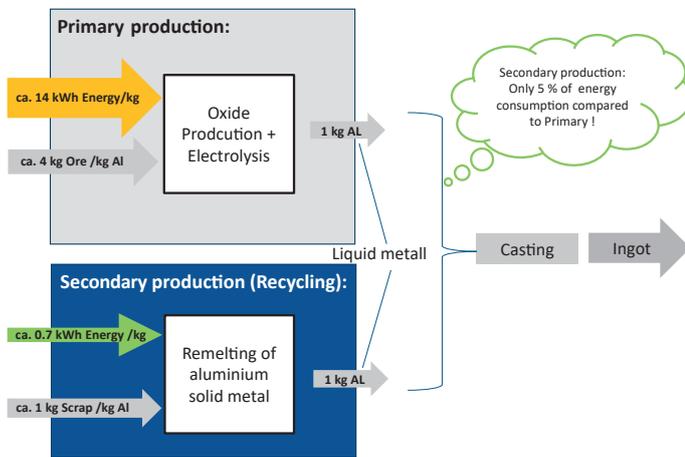
- We systematically assess the risks and opportunities related to safety, health and the environment.
- We continuously improve safety and health aspects. The focus is on risk reduction through systematic risk assessment and evaluation through forward-looking key figures as well as employee involvement.
- We continuously improve environmental aspects. The focus is on energy efficiency, CO<sub>2</sub> reduction and recycling management for our aluminium metal. In the long term, we are striving for climate-neutral production.
- We comply with legal regulations and other binding obligations.
- We support our partners in improving product design and recycling-friendly production as part of our role as a joint venture.
- We document our commitment through certification to the relevant standards ASI, EMAS, ISO14001, ISO45001.

# On energy

## About use and efficiency increases

Aluminium in the cycle is energetically profitable. The production of aluminium from bauxite mining to electrolysis is known to be very energy-intensive. Used aluminium metal, on the other hand, can be reprocessed for new rolled products with only about 5 % of the energy required for production. This is done in our remelt plant, among other places.

Our remelt plant has also been working for decades to constantly improve the energy required for remelting. As much recycled metal as possible and as little energy use in the melting plant as necessary is understandably one of our Focus 5 objectives to improve the ecological footprint of our rolled strips. The following chart illustrates the current energy flows from production and (re)melting.



In the case of return metals, we try to conclude fixed return agreements with customers together with the shareholders and thus actively close the aluminium cycle. However, as the quality of the metal changes with increasing return metal, other types of furnaces are indispensable for melting it down. Furthermore, other storage concepts are necessary in order to be able to feed the furnaces as purely as possible.

Our new project – recycling furnace 3 – will create additional melting capacity from 2023 in order to increase the use of return scrap. We will also use a different type of furnace. In this process, the impurities will serve as a fuel substitute and reduce the need for natural gas.

In addition, the yield of aluminium will be increased and the dross content reduced. For the third furnace, the storage area will also be enlarged in order to also improve the single-variety charging.

The automation and optimisation of the charging process for the melting furnaces (BIS project) is already being realised. This should further reduce the proportion of primary metal used.

## Our energy sources – natural gas and electricity

Natural gas is the fossil fuel with the lowest specific CO<sub>2</sub> emission. Natural gas is used for melting aluminium, keeping the melt warm, preheating the ingots, annealing

strips and operating the hot water system. At around 70%, natural gas is the main energy source.

The use of electricity will become increasingly CO<sub>2</sub>-friendly in the coming years, as the share of regeneratively generated electricity will increase and the efficiency of the producing power plant park will also rise. The main electricity consumers are the rolling mills. Around 30% of the total energy demand is covered by electricity.

## Less energy is more...

The reduction of energy use and the improvement of energy efficiency have been pursued by ALUNORF with great effort for many years, as this has a significant impact on the environment. In times of climate protection, the issue is further intensified by the question of how, for example, natural gas can be replaced for production purposes in the future.

The further optimisation of energy demand up to decarbonisation is not a simple matter and requires precise analyses of the current state, new technologies and considerable investments. In the process, the modification of existing plants while maintaining production comes up against various limits. But we are also facing up to this.



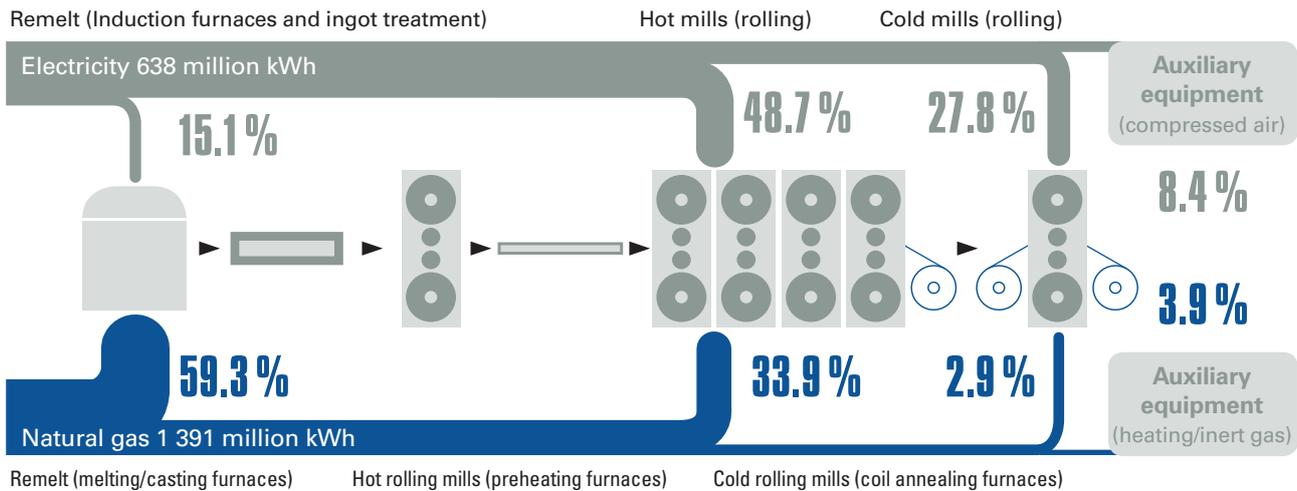
Remelt furnaces with waste heat recovery

The list of successful energy-saving measures in recent years is long.

Some striking examples were:

- Waste heat utilisation of remelt plant, district heating supply (funded project by the Federal Ministry for Environment)
- Preheating of combustion air from waste heat with regenerators/recuperators at the remelt furnaces
- Soaking pits with direct firing and better insulation
- Optimisation of the compressed air system
- Adjustable electric drives for blowers, especially scalpers and remelt furnaces
- Annealing furnaces 30 - 34 (funded project by the Federal Ministry for Environment)
- Delivery of liquid metal instead of solid metal

## Simplified energy flow



## Big-Data – Avoid losses

### „Advanced-Analytics“-Program

The reduction of ALUNORF's energy demand has traditionally been linked to technical measures, as evidenced by many impressive examples. Energy balances have been and continue to be used to highlight the effectiveness of the processes. The data available for this is comparatively clear.

Every process is subject to many influencing variables and not only obvious ones. Finding these out and using them for improvements – in other words, avoiding losses – is the goal of the „Advanced-Analytics“-Program. This involves collecting and analyzing data available in the plant for statistical evaluations (big data analyses). In this way, significant energy-saving potential can be derived and realized. At the same time, the knowledge about the function of the processes is deepened.

In 2021, the following „Advanced-Analytics“-Projects were carried out:

#### Improvement of the stability of the casting process:

- lower scrap rate when casting rolling slabs
- significantly less time lost due to casting stoppages
- reduced energy consumption in relation to good production

#### Reduced waiting time of hot mills due to material shortage:

- Standstill power consumption reduced
- Throughput of the hot roll and preheating furnaces increase

#### Fewer scratches on automotive metal sheet:

- Scrap rate (rejects) significantly reduced

### „Energy Expert Community“

The new „Energy Expert Community“ working group aims to find, analyze and implement existing ideas and opportunities for improvement more quickly. In addition, we are pooling the knowledge available in the plant here in order to methodically support the topic of energy saving. This will result in close links to the decarbonization of production.

### District heating Allerheiligen and industrial park Tucherstraße

For many years, we have been supplying waste heat from our remelt plant to the Neuss public utility company to supply the Neuss Allerheiligen district and

the Tucherstraße industrial estate. The quantities of heat supplied are still increasing. We use part of the recovered waste heat ourselves. Heating with waste heat is active climate protection.

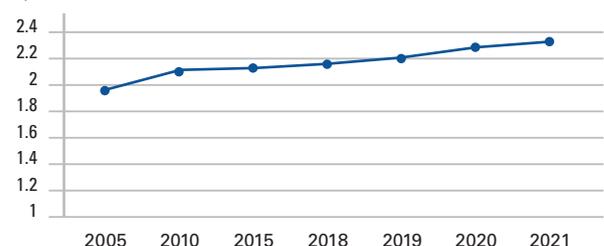
## The market is changing

### Depth of production has been increasing for years

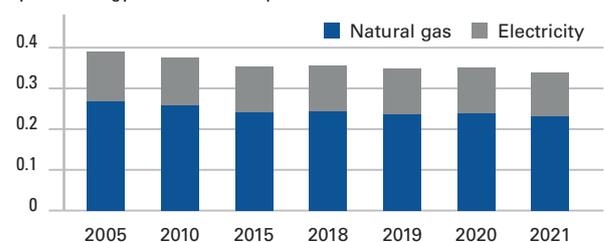
Our product portfolio is shifting significantly towards harder alloys. This is associated with an increased energy input during rolling. To compare the effort with a standard product, we determine a factor - the „equivalence factor“. This is the ratio of the production time of the product to the production time of the standard product. Equivalence numbers above 1.0 mean an additional expenditure of time and thus also energy for the respective product.

The following picture shows in the upper part the temporal development of the equivalence at the cold rolls as an example.

Equivalence factor Cold mill 1-5



Specif. energy related to total production MWh/ST



Classical energy indicators, e.g. kWh/t (metric), do not capture the additional effort. Energy improvements are therefore difficult to prove. For this reason, an energy performance indicator in kWh/ST (standard tonnes<sup>1)</sup>) is also used. This takes into account the different effort (required rolling capacity). In this way, improvements in the rolling process can be shown. The graph shows that with the exception of 2020 (effects of the corona pandemic) the energy input was reduced.

1) Definition of the standard tonne s. Glossary

# Energy optimisation

The economical and efficient use of all energy sources will continue to be one of our central objectives in the future, not least because of the associated and rising costs. Thus, further intensified efforts for energy optimisation are planned. The „ecological footprint“ will be defined as a new core area of our „Focus 5“ from 2022. Here we want to achieve significant improvements in the future.

In concrete terms, the following major technical adjustments are being planned or implemented:

- New direct-fired soaking pits 21/22 to replace the existing soaking pits 21-23 from the 1980s (environmental noise is also reduced!);
- New nitrogen supply with simultaneous elimination of the existing inert gas generators (natural gas combustion) an reduced compressed air consumption for supply of the existing air separation plant;
- Implementation of further improvement opportunities from the above-mentioned „Advanced Analytics“ projects.

Further projects are under preliminary consideration and must be agreed with the shareholders as usual in order to secure financing.

Since the criteria for the economic viability of projects in the industrial sector are generally not met on the basis of energy savings alone, extensive preliminary work is necessary to develop sensible project proposals. To this end, we want to intensify our cooperation with plant construction companies and research institutes.

Years of successful energy optimisation have reached limits that can only be overcome with new technologies. This also involves other energy carriers or energy sources, which are in the context of the decarbonisation strategy of climate protection. As a producer, we are dependent here on partnerships as well as on public funding for projects. This is a task for society as a whole, to which we want to make our contribution.



Remelt furnace 13 with regenerator burners. Charging with furnace cover open

# Greenhouse gases

The release of greenhouse gases leads to climaterelated warming of our planet. To limit warming, an international agreement was reached with the Paris Climate Agreement: warming is to be limited to a maximum of 1.5 degrees. The resulting climate change represents a major challenge for all of humanity, both for current and future generations. ALUNORF continues to set ambitious goals in this regard and aims to be climate neutral by 2050.

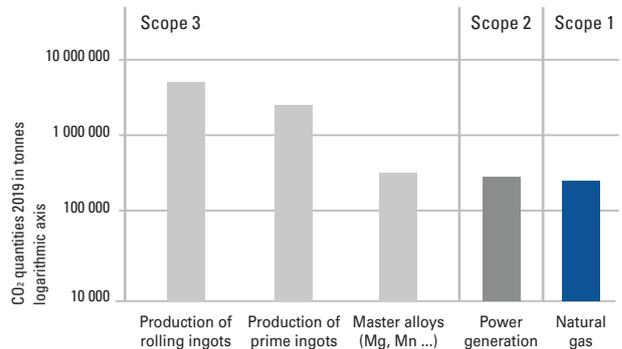
## Carbon dioxide (CO<sub>2</sub>) – Inventory

The recording of the CO<sub>2</sub> quantities is based on ISO 14064, which divides direct and indirect releases into „Scope“ 1 to 3:

- Scope 1: CO<sub>2</sub> quantities directly on site
- Scope 2: CO<sub>2</sub> quantities indirectly from energy use
- Scope 3: CO<sub>2</sub> quantities indirectly other sources.

Scope 1 mainly includes the quantities from natural gas combustion. Scope 2 mainly includes electricity. The releases take place in the power plants (indirectly), i.e. not on the plant premises. We record all quantities from Scope 1-3 in a CO<sub>2</sub> inventory.

The following diagram shows the main sources of CO<sub>2</sub>:



The production of the metals we process is the main focus in terms of quantity. Since these are delivered to ALUNORF, they are indirect and belong to Scope 3. The delivered rolling ingots and massels are procured by our shareholders and remain their property. Therefore, ALUNORF has no relevant influence on a possible reduction of these CO<sub>2</sub> quantities. As a result, these quantities are not followed up in the CO<sub>2</sub> balance (P.20).

Nevertheless, CO<sub>2</sub> reduction in relation to these metals is supported within the shareholders' decarbonisation strategies. The aim is to increase the proportion of recycled metal used at the site as far as possible. The Scpoe 3 share is reduced by lowering the share of new aluminium (primary metal) is reduced.

The transports for the delivery of the metals and for the delivery of the products manufactured by ALUNORF are also organised and commissioned by the shareholders. The associated CO<sub>2</sub> quantities also fall under Scope 3 and are the responsibility of the shareholders ALUNORF does not report these quantities.

## Greenhouse gas balance – Our CO<sub>2</sub> quantities

All significant and controllable greenhouse gas quantities of ALUNORF therefore fall within Scope 1 + 2.

The relevant sources are energy-related:

- Scope 1:  
CO<sub>2</sub> quantities directly from use of natural gas
- Scope 2:  
CO<sub>2</sub> quantities indirectly from use of electricity

In **Scope 1** greenhouse gases from different sources are summed up as CO<sub>2</sub> equivalents.

The emission factor for natural gas is calculated on the basis of the chemical composition of the deliveries to ALUNORF. This also applies to the diesel used.

Emissions of other greenhouse gases (apart from CO<sub>2</sub>) such as methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) or refrigerants are low compared to CO<sub>2</sub>. These gases are produced by the following sources and are also classified as Scope 1:

- Process emissions from the incineration of organic scrap build-up in the recycling centre
- Diesel consumption
- Refrigerant use / leakages
- CO<sub>2</sub> extinguishing systems
- Waste gas emissions as CH<sub>4</sub>, N<sub>2</sub>O

The resulting greenhouse gas equivalents for CO<sub>2</sub> are calculated using fixed emission factors and the energy or consumption data. The current emission factors are shown in the table on p. 20. CO<sub>2</sub> emission factors are also used in Scope 2. In the case of electricity, these can differ considerably depending on the production. In addition, the determination of the emission factors is currently always validated in the 4th quarter of the following year. This affects the reporting options.

We therefore always report with a fixed emissionsfactor  $eCO_2 = 0.67 \text{ kg CO}_2/\text{kWh}$ . This calculation basis comes from the voluntary commitment of German industry and the associated RWI data monitoring. The use of the emission factor, which is constant over time, also ensures that our technical improvements in terms of CO<sub>2</sub> quantities from electricity can be determined.

With the perspective of complete decarbonisation of operations as well as sustainability reporting, the sole use of this emission factor no longer makes sense. Therefore, the amount of CO<sub>2</sub> is now additionally stated with the emission factor of the German electricity grid (published by the Federal Environment Agency) and also based on the information provided by the electricity supplier. In addition to the point in time in the following year, the respective current specifications for the determination must also be taken into account. ALUNORF has no influence on any of this, so our focus remains on the fixed emission factor.

**Scope 2** also includes releases from the upstream chain, such as natural gas production or crude oil production and diesel processing.

The main quantities caused by the use of natural gas and diesel are released directly and are included in the Scope 1 data. Therefore, the information on the upstream chain is not provided, especially since the emission factors available in the literature only represent estimated values and the amount of indirect releases is thus low.



Planned recycling furnace 3 of the type shaft furnace

## CO<sub>2</sub> Reduction targets

The reduction and even more so the renunciation of fossil energy sources are an ambitious effort by all social forces. Avoiding climate-relevant gases requires a long-term strategy, but also a constant stream of new concrete projects.

We associate the Ecological Footprint of our Focus 5 with the following longer-term objectives:

1. **We want to reduce the carbon footprint of our aluminium coils by 30% by 2026 compared to 2015.**  
The CO<sub>2</sub> quantity from Scope 1 and Scope 2 with the partial quantities from natural gas combustion, electricity generation, diesel use and process emissions are taken into account in relation to the shipment quantity.
2. **We want to reduce specific energy consumption by 6 % by 2024 compared to 2021.**
3. **We will achieve climate neutrality by 2050.**
4. **We support our shareholders in reducing carbon footprint of aluminium rolling ingots (Scope 3).**

Milestones are the projects for the automation of the charging process in the remelt plant (BIS), with which we want to achieve a CO<sub>2</sub> reduction (essentially Scope 3) of more than 500 000 t/a, and the new recycling furnace 3.

The achievement of these targets depends on the availability of investment funds, which are not yet guaranteed in the long term.

For 2022, our target is to reduce specific energy use by 1% compared to the reference period October 2020 to September 2021. Projects are planned to achieve this. The decisive factor will be that production goes as planned and is not strongly influenced by the pandemic as in 2020.

# Our CO<sub>2</sub> quantities

The table below shows our CO<sub>2</sub> quantities. In previous environmental statements, a distinction was made between direct (on-site) and indirect (off-site) emissions. By referring to Scope 1 and Scope 2, we are adapting to standard international criteria for differentiating between types of emissions. This is also necessary with regard to sustainability reporting and the ASI standard.

In Scope 1, the data for natural gas, diesel and the combustion products of paints and coatings are taken into account on the basis of defined emission factors. The other greenhouse gases methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O) or refrigerants are converted to CO<sub>2</sub> quantities, so-called CO<sub>2</sub> equivalents).

As explained, information on Scope 2 (upstream chain) and Scope 3 will be omitted from 2021 onwards, as ALUNORF mainly has no influence on these quantities or they are comparatively very small.

The CO<sub>2</sub> quantities are determined in accordance with ISO14064.



Remelt furnace - Addition of liquid metal

Scope 1 Direct Emissions	Equiv.-Factor 1)	Volume 2021 t/a	Volume 2021 [t CO <sub>2</sub> eq/a]	Percentage of total CO <sub>2</sub> %
Combustion of gas at site	1	254 522	254 522	36.7
Incineration of lacquers and coating in the recycling-centre (process emissions)	1	4 988	4 988	0.7
Diesel for vehicles incl. emergency power supply	1	3 563	3 563	0.5
Methane	28	91	2 537	0.4
Cooling agent losses	div.	0.27	342	0.0
Fire extinguishing devices	1	37	37	0.01
Di-nitrogen-monoxide	265	0.13	36	0.01
Poly fluorinated hydrocarbons (PFC)		0	0	0
Sulphur hexafluoride (SF <sub>6</sub> )		0	0	0
Scope 2 Indirect Emissions	Equiv.-Faktor 1)	Volume 2021 t/a	Volume 2021 [t CO <sub>2</sub> eq/a]	Percentage of total CO <sub>2</sub> %
CO <sub>2</sub> from electricity generation by the electricity demand ALUNORF calculated with different emission factors:				
Public electricity supply 1990 constant 0.67 kg CO <sub>2</sub> /kWh <sup>2)</sup>	1	427 141	427 141	61.6
Electricity mix Germany 2020 – 0.366 kg CO <sub>2</sub> /kWh <sup>3)</sup>	1	233 334	233 334	–
Electricity supply ALUNORF 2020 (Axp0) – 0.59 kg CO <sub>2</sub> /kWh <sup>4)</sup>	1	376 139	376 139	–
<b>Sum Scope 1 CO<sub>2</sub> emissions direct</b>			<b>266 025</b>	<b>38.4</b>
<b>Sum Scope 2 CO<sub>2</sub> emissions indirect (Factor 0.67 kg CO<sub>2</sub>/kWh) <sup>2)</sup></b>		<b>427 141</b>	<b>61.6</b>	
<b>Gesamtsumme</b>			<b>693 166</b>	<b>100</b>

1) Equivalent factor: Global warming potential of a gas in relation to CO<sub>2</sub> GWP100 according to the 5th progress report of the IPCC 2013  
Coil transport is organised by the shareholders Speira und Novelis.

2) The value is 0.67 kg/kWh and corresponds to the CO<sub>2</sub> emission factor of electricity from public power generation for the base year 1990 (RWI Essen: Monitoring Report 2000-2002, page 269), source: <https://www.rwi-essen.de/forschung-und-beratung/umwelt-und-ressourcen/projekte/co2-monitoring/>.  
This factor is used to determine technical improvements of the Alunorf. This factor is used for the total Alunorf (balance frame location Neuss).

3) CO<sub>2</sub> emission factor electricity mix Germany 2020 Federal Environment Agency May 2021: 0.366 kg/kWh,  
Source <https://www.umweltbundesamt.de/themen/klima-energie/energieversorgung/strom-waermeversorgung-in-zahlen?sprungmarke=Strommix#Strommix>

4) CO<sub>2</sub> emission factor electricity mix Alunorf 2020: 0.59 kg/kWh, Source electricity identification from electricity deliveries to end consumers in 2020 of Axpo Deutschland GmbH, pursuant to § 42 of the Energy Industry Act of 07 July 2005, amended 2021; status 10/2021.

## Air pollutants

Other than greenhouse gases with global impact, air pollutants rather cause regional or local effects. In this respect the protection of nature and men's health has priority.

Air pollutants are subject to examinations and permits by environmental authorities. Defined limiting values have to be regularly checked. In order to safeguard the adherence to these values a couple of waste gas cleaning units and filters are used. The table shows what we do to minimize the emission of air pollutants.

### Nitrogen oxides and hydrocarbons (Oils)

The most important air pollutants are nitrogen oxides and organic hydrocarbons.

Nitrogen oxides result from combusting natural gas in our furnaces at high temperatures. Therefore we take measures at the burners / burner technology to reduce emissions.

Organic hydrocarbons mainly result from oil used in our rolling processes. The waste air filters at the rolling mills even gain rolling oil. This idea was developed by ALUNORF in the 1970s and since then has been used worldwide!

The bar charts on pages 26/27 show the development since the implementation of our environmental management system in 1996 in terms of specific emission per ton of shipped band. All data on air pollutants are included in the Input-Output-Balance on pages 36/39.

### Inorganic chlorine compounds

Chloric air pollutants result from production in remelt where chlorine is used to purify liquid metal so that chlorine, chlorides and hydrogen chloride get into the

waste air flow. These pollutants are removed in a 2-step treatment (caustic soda and lime).

### Carbon monoxide (CO)

CO emissions result from the insufficient combustion of natural gas mainly when switching our burners on and off. State-of-the art burner controls make sure that correct air volumes are used leading to considerable reduction of CO emissions.

### Dust and dioxines/furans

Dust results from different process steps in remelt. It is collected and almost completely retained in three waste gas cleaning units equipped with filter bags. To avoid the emission of dioxines and furans in the recycling unit coke is added that is retained together with dust.

### Sulphur dioxide

The very small portion of sulphur in natural gas is turned into sulphur dioxide when combusted. Against other air pollutants the volume is neglectable

### Odours

Emulsions and rolling oils in the hot mill and cold mill area may cause odours with oily characteristics. They are reduced as much as technically possible by waste air cleaning units. What goes up into the air nevertheless is admissible acc. to the permit of local authorities on the basis of the Odour Emissions Guideline for North-Rhine Westphalia as there is no health risk involved from odour characteristics and times when odour is perceivable is below the limiting values.



Waste gas cleaning in cold mill

### Air pollutants and counter-measures to reduce them

Production	Air pollutants	Counter-measures
Remelt	Nitrogen oxide Carbon monoxide Chlorine + Chlorides Dioxins/Furans Dust	<ul style="list-style-type: none"> <li>○ Burner technology</li> <li>○ Caustic soda scrubber</li> <li>○ Bag filters with lime or lime mixture</li> </ul>
Hot mill area	Droplets Oil mist Odours Nitrogen oxide	<ul style="list-style-type: none"> <li>○ Burner technology</li> <li>○ Activated carbon filter</li> <li>○ Droplet separator</li> </ul>
Cold mill area	Droplets Oil mist Odours	<ul style="list-style-type: none"> <li>○ State-of the Art exhaust air scrubber (dripping-free Airpure equipment)</li> <li>○ Rolling oil recycling</li> </ul>

# From ground water to waste water

## Water extracted from soil

### Ground water

Cooling water in particular to cast ingots and to formulate emulsions is extracted by our own well system. The water is decalcified, desalted and filtered. The volume is recorded and the quality monitored.

### Water is used several times

Our cooling water flows in a cycle. By improving the cycle systems we were able to reduce the overall water consumption related to one tonne of rolling band over many years.

### Drinking water protection

In order to protect the drinking water supply in the Neuss Rhine area we have been extracting ground water under our plant since 2005. The water is mainly used at our plant. The water in excess is directly charged into the Rhine (sumpwater).

## What goes into the River Rhine

### Waste water

Waste water is treated in our four purification facilities. We collect rain water and sewage in separated sewers. Both systems are regularly monitored and cleaned. Sanitary water from showers or toilets and water from use in production (waste water from casting and rolling) are cleaned in our central biological purification plant prior to being charged into the Rhine. In the emulsion separating plant (technically: vaporisation plant with distillation principle) we separate used emulsion and oil-contaminated wash water without adding chemicals into water and oil. Recycled oil can be returned to waste oil recycling plants.



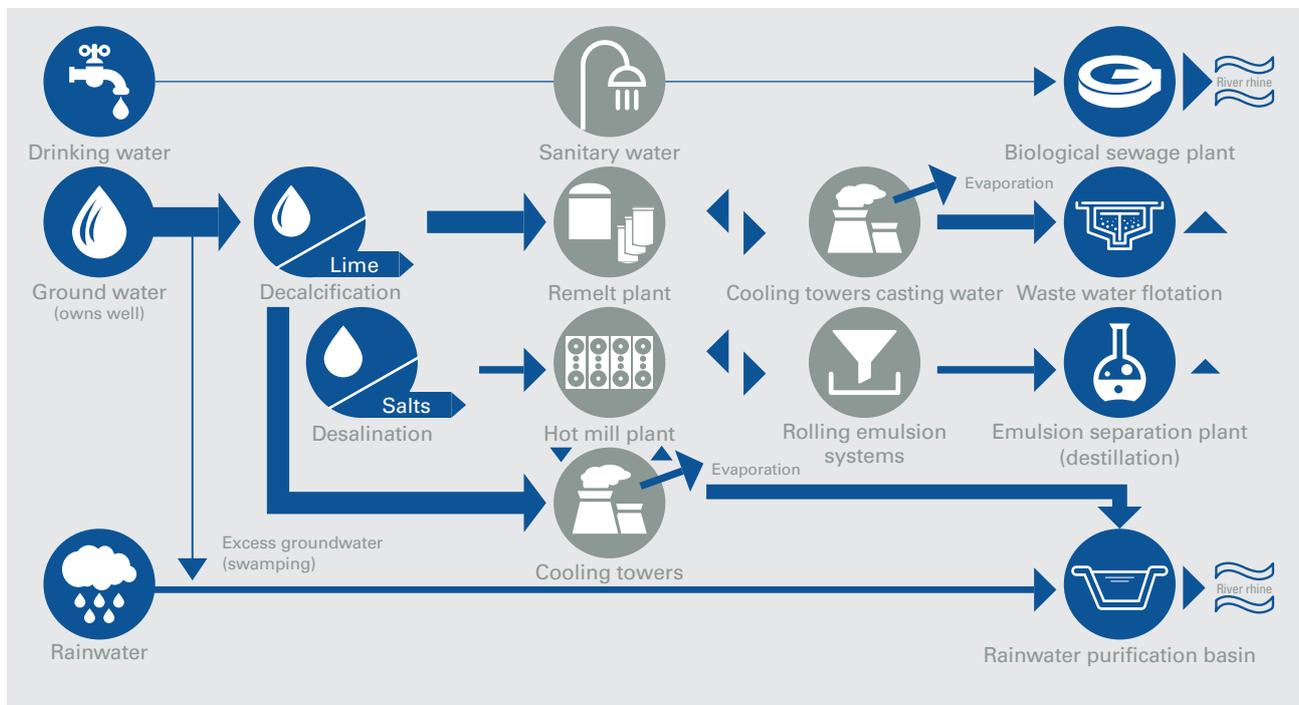
Biological sewage plant

In the waste water flotation plant (technically: pressure relief flotation) unsolved organic components of the waste water from casting water cycles and the emulsion separating plant are removed. The waste water from flotation flows to the biological sewage plant.

From there it is tested online and examined in our own and in external labs. Public authorities take samples without notice.

The rain water from our traffic ways, places and roofs are subjected to mechanical cleaning with separation of settleable solids (among others sand) and floatables (mostly oil).

In the end the entire volume of cleaned waste and rain water flows into the Rhine through a drainage canal. We are protected against high water by an overflow weir in the dyke system.



## New water treatment

Water is a basis of life. For decades, the use of water for industrial purposes has been associated with requirements for recycling, multiple use and the avoidance of wastewater-intensive process technologies. Use of drinking water for production purposes is prohibited.

ALUNORF has 5 cooling water circulation systems. We currently use decalcified groundwater from our own wells as make-up water. This approach allows a water consumption of about 1m<sup>3</sup> per ton of rolled strip, one of the most efficient values worldwide.

Maintaining these low consumption levels is proving increasingly problematic. Both hygiene and product quality requirements, and not least the EU's zero pollution strategy, demand new water and wastewater qualities. We have to face up to this.

In the future, we plan to increase the use of multiple water sources and improve the existing water treatment with 2 new reverse osmosis stages. Recent research shows that the water properties should be much more uniform when casting the ingots and should contain less salts to avoid cracks in the ingots. We have successfully tested this with a mobile test plant for water treatment on casting water circuit 4 (cooling tower 4).

The test plant essentially consists of:

- Stage 1 - removal of iron and manganese from the groundwater by aeration and filtration.
- Stage 2 - desalination in a reverse osmosis lake to produce fully desalinated water.

To optimize the properties for the casting process, some first-stage water is added to the fully demineralized water. The trials, which are still ongoing, are showing the hoped-for effect, so that this new principle is to be permanently installed in the existing water treatment system (Project 137). In addition, a further reverse osmosis stage (stage 3) is planned to treat any concentrate wastewater produced.

The following advantages are associated with the project:

- the waste water flow of the waste water flotation decreases by approx. 10%
- the reduced water flow through the recirculating water system (cooling towers) reduces the amount of cooling water treatment chemicals by approx. 20%.
- the discharge of waste water constituents will be approx. 10% lower.

The reduction of rolling ingot cracks reduces the scrap rate, so that the specific energy and water requirements in relation to the good production are also further reduced by this project.

## Flood protection

The 2021 flood disaster on the Ahr and in other areas has also put the topic back on our agenda.

Floods or heavy rain can cause a breakdown of production facilities, and intrusion into halls, buildings and cellars must be prevented.

After 2 extreme rainfall events in 2000 and 2007, the following measures were implemented at ALUNORF in this regard:

- Protective walls, folding and plug-in bulkheads to protect critical buildings from water ingress in the event of flooding of the plant roads during heavy rainfall.
- Removal of fixtures in the main storm sewers to improve drainage during heavy rains
- Modification of the flow routing in the wastewater collector at the rainwater clarifier to improve the delivery capacity of the flood pumps during Rhine flooding



Plug-in bulkheads for flood protection

Simulation calculations show that safety against flooding has been considerably improved. In the future, however, even heavier heavy rainfall may occur than in the past, so that further protective measures will also have to be realised in the future.



Test facility for water treatment at cooling tower 4 with reverse osmosis modules (in white)

# Noise

## Environmental noise

Environmental noise is easily perceivable even without measurements. If there are different sources of noise only the one with the highest noise level is heard. Particular emitters can no longer be measured.

## Noise from machinery

At the official noise measuring points the noise emitted by ALUNORF is nearly completely masked by noise from motorways A57 and A46, main road B9 and railway line Köln-Neuss. Physically this is more than tenfold (traffic noise >10 dB(A) higher) which is also confirmed by subjective impression. Our noises can thus only be determined with calculations addressing every noise source (also internal traffic) as well as the insulation dimensions of our buildings.

As a result the calculation model shows the share of ALUNORF's noise at the particular reference points in the vicinity of ALUNORF. Critical is the noise at night (higher interference effect → lower limiting values). All limiting values defined by public authorities are adhered to day and night.

## Supplies and shipments

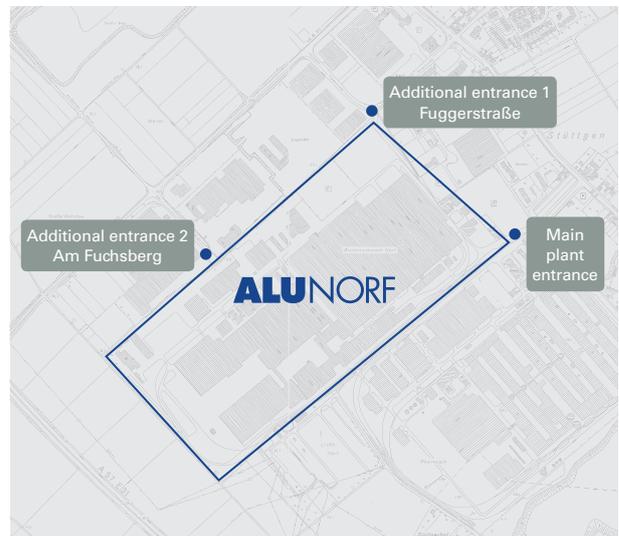
Aluminium ingots for our hot mills are delivered mainly by ship and rail. Sheet ingots from adjacent Rheinwerk of Hydro are transported through a gate between the two plants without using public roads. Liquid aluminium and operating supplies are delivered by trucks.

Finished cold and hot band is shipped by rail, ship or truck according to the distance to be covered and logistics of recipients.



24 Electric vehicle for liquid metal pots

# Transports



The share of transport by rail is approx. 17% and that by ship approx. 6%. A major share of truck transports goes to Grevenbroich approx. only 20 km away. Therefore these trucks cause only minimal traffic load.

## Logistics centralised

There are still challenges for the logistics of supplying the factory with raw materials and shipping finished products: High or low Rhine levels prevent delivery or shipment by ship. Rail strikes or bad weather prevent delivery and dispatch by rail. HGVs sometimes arrive in large numbers in a short time and clog the factory entrance. Truck drivers are not available.

In 2021, the logistics in the factory were combined in a central department that can better utilise the possibilities for cooperation between the individual subprocesses. With the new department, the realisation of the time-slot system for the delivery of solid metal was also tackled.

Up to now, „time-slot“ was only used for the shipment of strips. With this system, the forwarding agents are assigned a short time slot for each commissioned delivery/delivery, in which the truck must arrive. Only if the truck arrives on time is it allowed to enter the factory and is dispatched. Since the allocated time slots are evenly distributed over the daytime, this results in an equalisation of traffic flows. Therefore, the likelihood of traffic jams is reduced because several trucks (possibly in a convoy) no longer arrive uncoordinated at the same time.

## Waste is useful

We separate more than 40 types of waste

More than 40 different types of waste e. g. scrap wood, construction waste and used paper are collected and separated in our operating units and transported to a central waste collection area. There wastes are stored for disposal by a licensed carrier and if needed re-sorted by trained staff. Separation is prerequisite to later reutilisation. The diagram shows the types of waste with the highest volume at ALUNORF in 2021.

### Avoid waste is better

Packaging coils is largely minimised as far as this is compliant to customers' specifications. The cold-rolled coils are often wound on spools. Packaging accounts for only 5 % of the overall shipped tonnage. More than half of these 5 % result from thick-walled steel spools that serve as re-usable carriers for our rolled aluminium coils. They are returned to us bare and then used again as carrier for our coils.

### Main measures to avoid waste:

- The emulsion separation plant recycles mixtures of oil / water so that the water phase can be discharged together with waste water into the biological sewage plant.
- Oil-rich oil / water mixtures are thickened so that only the enriched oil phase needs to be disposed of.
- Used emulsion is reprocessed in a cleaning system so that the oil concentrate can be used as fresh material to mix new emulsions.
- Rolling oil filter operations are optimised so that only a small amount of fresh filter earth is consumed.

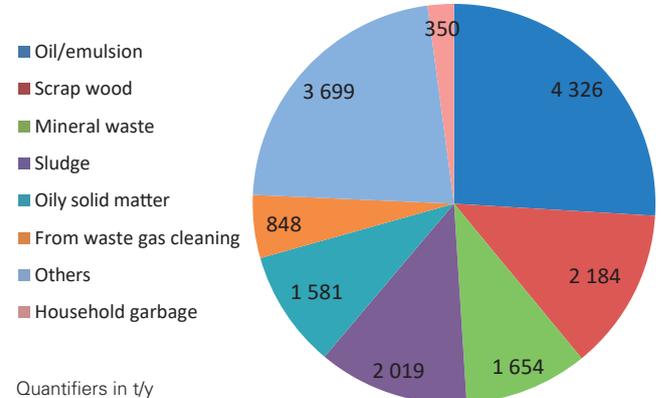
### Aluminium from dross

Dross from production in remelt is legally defined as waste (approx. 50 000 t/a), but for us it is a valuable by-product of melting.



Dross skimmed of during the the melting process.

### Types of waste in 2021



Dross contains more than 70% of metallic aluminium so we recycle it free from contaminations. The aluminium gained in this process is charged again into our melting.



Dross hall

### Dross handling

To put it bluntly, dross is burnt aluminium. This floats on the surface of the liquid aluminium and must be regularly peeled off (photo left). Hot dross contains liquid metal and reacts with air. The following measures reduce the amount of dross and aluminium losses that occur:

- Optimised haul-off to reduce the amount of dross that needs to be reprocessed;
- Dross bucket with bottom discharge opening, collection of the liquid metal and use in our smelting furnaces;
- Cooling of the dross with the use of inert gas or compacting with a hydraulic press to prevent further oxidation in the hot material.
- Separation of the dross according to alloy groups in order to be able to use the returned metal precisely after processing.

Dross recovery takes place in special furnaces in Grevenbroich. Most of the recovered aluminium is delivered in liquid form. This avoids remelting and saves natural gas.

# What we have improved

Our achievements for environment and energy efficiency



Water consumption  
**+ 8 % since 1996**  
 (+ 9%)



Energy input  
**- 25 % since 1996**  
 (- 24%)



Air pollutants <sup>1) 2)</sup>  
**- 47 % since 1996**  
 (- 49%)



Waste volume  
**- 66 % since 1996**  
 (- 66%)

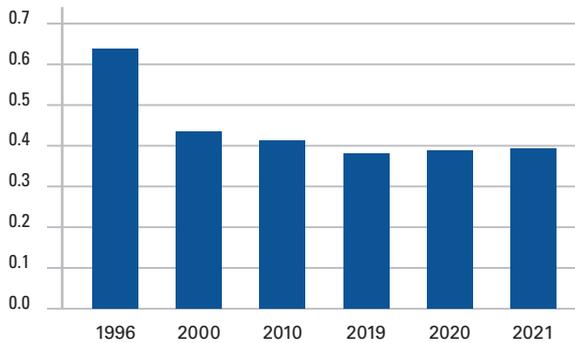


Previous year's figures in brackets

<sup>1)</sup> Sum of nitrogen oxides and hydrocarbons

<sup>2)</sup> Explanations page 39

## Nitrogen oxides



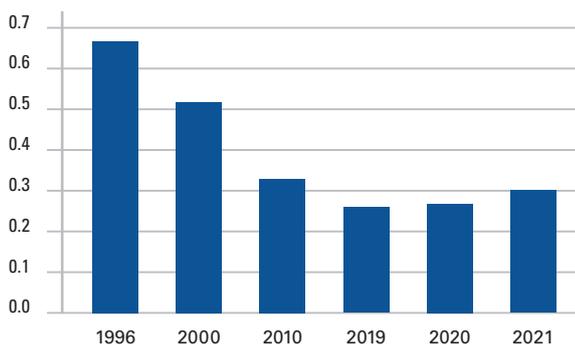
kg nitrogen oxides

t shipped rolled band

Key figures air pollutant nitrogen oxides from burners

**Achieved -39%**  
 against reference year 1996

## Hydrocarbons



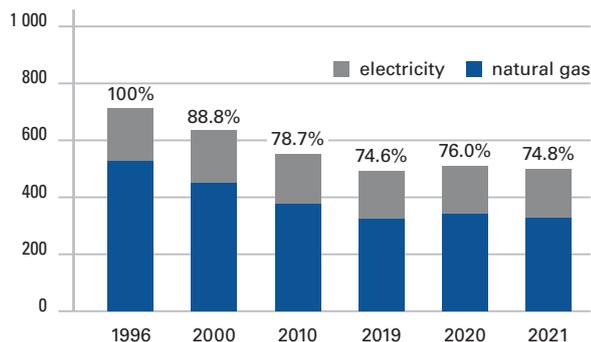
kg hydrocarbons

t shipped rolled band

Key figures air pollutant hydrocarbons

**Achieved -55%**  
 against reference year 1996

## Energy



kWh energy (total natural gas and electricity)

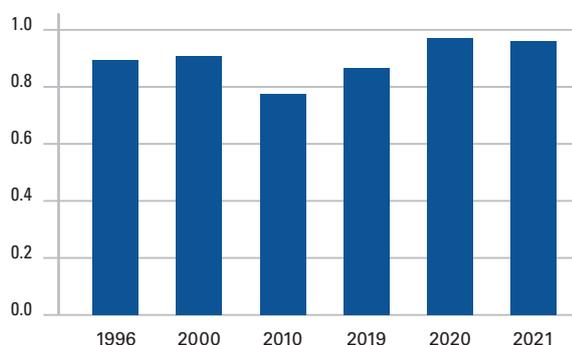
t production (total of all production units)

Key figure energy

**Achieved – 25.2%  
against reference year 1996**

Stable level – changes in product mix (more hard alloys) offset efficiency improvements from process technology

## Water



m³ ground water

t shipped rolled band

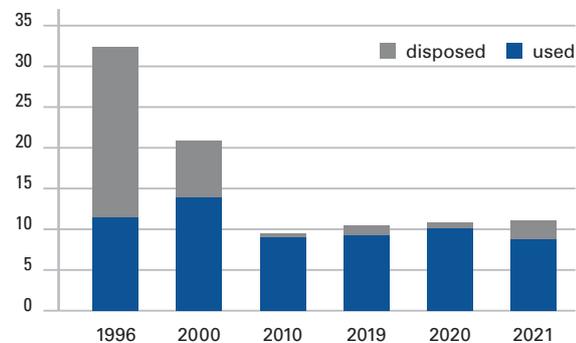
Key figure water

**Achieved + 7.8%  
against reference year 1996<sup>1)</sup>**

Increased water demand, a.o. from higher additional water volume for cooling water cycles for hygiene reasons.

1) Deep-well pumping for drinking water protection not considered

## Waste



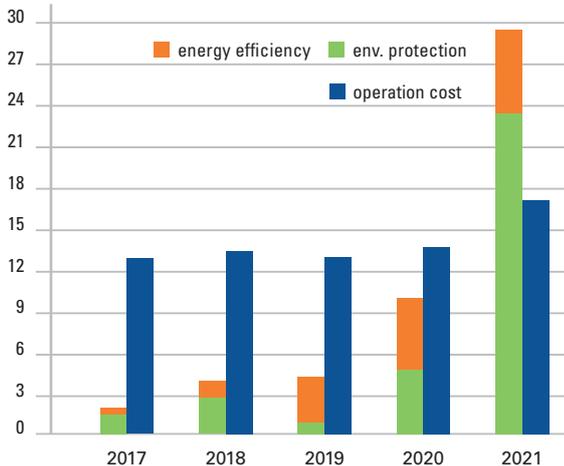
kg waste

t shipped rolled band

Key figure waste

**Share disposed 2021: 22 %  
Share used 2021: 78 %**

## Environmental cost



million €

year

Key figure environmental cost

### Investments 2021

Energy efficiency/  
Climate protection 5.88 million €

Environmental protection 23.53 million €

### Operating cost 2021

Energy efficiency/  
environmental protection 16.83 million €

# Safety

Safety first: 24 hours – 7 days

## Safety Hour

Alunorf's managers take one hour a day – the „Safety Hour“. During this time, they conduct safety tours with colleagues on safety topics (e.g. traffic safety, machine safety) at the workplaces in order to engage in conversation and jointly develop ideas for improvement and follow up on agreed measures.

Within the framework of this safety lesson, special focus is also placed on the topic of safety coaching for managers. Here, particular attention is paid to whether the managers have the right eye for safety deficiencies, but also how they conduct a direct conversation with an employee on the topic of occupational safety at the plant.



Safety Hour

## Working in „confined spaces“

There are currently almost 600 identified „confined spaces“ at ALUNORF. The hazards that can occur when working in such spaces are manifold and sometimes pose a very high risk.

In addition to numerous technical adaptations and optimisations of existing „confined spaces“, such as the enlargement of access points in containers or the continuous procurement of new rescue equipment, the training of employees to reduce risks plays a decisive role.

When working in „confined spaces“, in addition to theoretical knowledge about possible hazards, the necessary measures, etc., practical implementation is an essential factor that contributes to raising the awareness of all those involved.



Exercise for rescue from confined spaces

„Hanging exercises“ with a safety harness in a tripod, simulated rescue scenarios of an employee from a container, etc. quickly show the complexity and difficulty of such work and a possible rescue.

In order to achieve this interplay between theory and practice and also to offer the staff a training that is fun and varied, training courses are now regularly offered with an exercise trailer (see photo).

## FACTS & FIGURES

In the USA, an average of 670 fatal accidents occur in „confined spaces“ every year. Studies by the US National Institute for Occupational Safety and Health (NIOSH) have shown, among other things, that

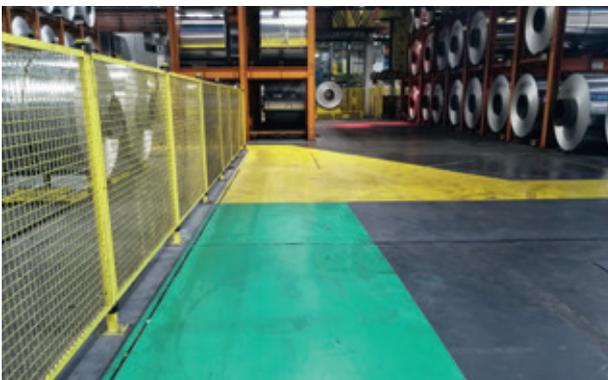
- 15 % of the employees were currently trained in this area
- 31% had completed a permit
- 0 % had a rescue concept
- 60 % of deaths were due to rescuers and their attempts to help victims out.

## New walkways for pedestrians

In order to continuously improve pedestrian safety at the plant, a new concept for marking pedestrian walkways and road crossings was introduced.

Walkways are now colour-coded according to the risk they pose to pedestrians, thus providing them with better orientation. The decisive factor for the colour marking is in particular the presence of vehicles or cranes in the immediate vicinity.

Furthermore, in an extensive project in the cold strip area, the course of the walkways was once again examined in detail in order to eliminate high-risk paths and to guide employees safely to their workplaces at the plants via new walkways.



New walkway markings

## Distance monitoring vehicles and cranes

Due to the high volume of traffic, there is always a risk of vehicles colliding with each other or with cranes. To minimise this risk, distance monitoring has been installed at many locations in the company in recent years to warn vehicles and cranes of each other.



Optical distance monitoring

In these cases, drivers receive a visual signal and can thus react more quickly. Furthermore, zones have been set up at several locations (e.g. intersections) in the plant where vehicles are slowed down to a reduced speed when they drive into them.

The system is now being continuously extended to the factory in order to equip more and more vehicles with this safety feature.

## ALUNORF Kids-Campaign

For one day, the children of Alunorf were able to slip into their parents' safety clothing. This sent a strong signal for occupational safety at Alunorf.

The many great pictures were hung on large banners throughout the plant as part of a safety campaign.

With slogans such as „Come home healthy - for you and me“, „Take care of yourself“, or „I'm looking forward to“ and others, the importance



# Reliable partner for safety

## Our fire brigade

In 1968 ALUNORF established its own fire brigade to fight fires on site. It was acknowledged as plant fire brigade in 1981 and was ordered in 2021. The plant fire brigade and fire brigade and plant security are assigned to the department, which is an indispensable building block in our environmental and safety culture.

Defensive fire protection as part of general risk protection comprises the organisation and effective deployment in fire fighting and technical support by 40 full-time and 25 part-time firemen. This includes deployment preparation and planning, regular training and maintenance equipment and 7 vehicles in operational readiness condition.

Preventive fire protection as part of averting dangers needs to ensure the functionality of our 21 stationary gas extinguisher systems, 74 sprinkler and deluge systems and 14 foam extinguisher systems. In addition, also maintaining and servicing 46 pillar hydrants, 110 wallmounted hydrant systems and 43 fire alarm systems with more than 2,500 fire detection elements are part of our fire brigade's duties.



Emergency exercise

The scope of our fire brigade's duties with approx. 270 emergency calls per year is no longer on fire fighting only. Technical support and in particular the fight against chemical hazards has become more and more important to which our fire brigade responds to with their vast knowledge and special equipment.

Within five minutes after receiving the emergency call our fire brigade with a group of 9 firemen will arrive at the scene. The officer in charge and 8 firemen comprising full-time and part-time fire fighters form the initial attack, are supported, if necessary, by further alarmed task forces and coordinated by the permanently manned fire brigade operations centre.

The training of our employees in the safe handling of fire extinguishers is also part of the fire brigade's tasks. Besides counseling our production units in terms of preventive fire protection daily checks on the shop floor ensure compliance to fire protection regulations.

The plant fire brigade coordinates and assists with 250 fire watches and 50 gas measurements per month as a basis for various repair tasks. These are measures to avoid accidents and fires. Also our fire-extinguishing systems are locked 250 times per month so that activities can be conducted in a safe manner.

Our fire brigade therefore is an important pillar in averting dangers; and in case there is an emergency the extent of damage is limited to the minimum by their rapid and efficient response.

24 hours a day, 365 days a year.



## Health is not everything...

But without health everything is nothing

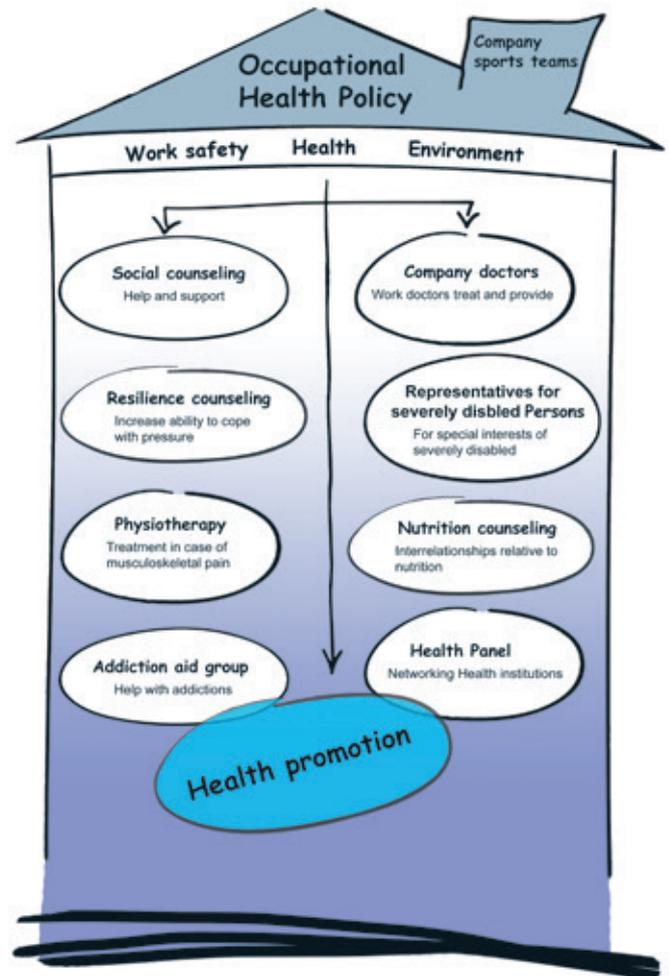
### Health promotion

Health is defined as physical, psychic and social well-being. There are many ways for everyone of us to strengthen our health. Health promotion lived at ALUNORF also stands for strengthening the well-being of our employees.

In the centre are people with their daily behaviour in terms of individual health and physical strength. Health promotion shall raise the awareness for everything that might help employees to stay healthy. This also means taking responsibility for oneself and act in a self-dependent manner.

### Prevention instead of reaction

In former times China had another way of paying doctors than today. They got money from their patients until the patients became ill who then stopped payment. What does that mean? The focus of doctors and health system was solely on acting in a preventive manner rather than letting patients fall ill.



## Suppliers / Contractors

Our commitment to environment is supported by qualified suppliers of products and services. When selecting and qualifying them we attach great importance to keeping legal provisions and standards for maintaining health and protecting environment and climate.

In particular contractors that work on our premises need to observe our guidelines; the same way we have regularly monitored our own behaviour by trained people they are subject to inspections as well. Suppliers in the field of waste and recycling economy are scrutinised thoroughly.

We strive for long-standing partnership and prefer suppliers with environmental certificates and established management systems. The most recent product and safety data sheets are part of our contractual agreements. Also with their information we safeguard processes and documentation over the entire ALUNORF value chain.

Furthermore, it is important to us to promote the idea of sustainability together with our suppliers. To this end, a sustainability maturity model was developed and implemented in 2020.

The model makes it possible to intensify the exchange on sustainability topics with our suppliers and to enter into a dialogue on the further development of relevant aspects.

The level of sustainability maturity is determined for each supplier and is included in the supplier rating. Progress is measured by updating the assessment on a regular basis.

Potential for development is communicated to the suppliers, and suitable measures are defined if necessary.

The model ensures that the suppliers deal with the topic of sustainability and continuously develop their organisation.

# Without system it does not work

## How we manage environment

We organise environmental and energy aspects under the environmental management system (EMS). Our strategic orientation is derived from our mission, our vision and our vision and our mission statement.

We regularly evaluate all relevant internal and external environmental issues, expectations, interests and compliance obligations (regulations) with regard to risks and potentials and derive potential measures for the environment (technical term: context analysis). As part of the annual business plan concrete improvement measures (projects) are defined.

Environmental protection is based on the obligation to strictly comply to limiting values and use operating supplies, energy and waste carefully. For potential emergencies we define rules as well. Each requirement is filed in data bases. This way we plan and control the implementation of our duties and respond to deviations.



Plan – Do – Check – Improve...  
...a continuous process

### Improvement of environmental performance

Volume inputs into the environment can hardly be limited by regulations only. Here company targets can close the gap. The reduction of the ecological footprint is a voluntary environmental performance. We use a reliable and comprehensive system to record, evaluate and control environmental data.

### Specifications for jobs and processes

Daily operations, the processes of ALUNORF's work environment are the organisational basis (technical term: process orientation). The way how to achieve desired results is defined. Besides manufacturing standards all our processes need to address safety, health and energetic aspects as well. This applies to production, maintenance and administration. With a software developed by ALUNORF we visualise the processes. The ALUNORF process model (APROM) can be accessed via a web browser.

### Closer involvement of employees

Clear responsibilities and competencies are prerequisites to execute environmental duties with care and in a traceable manner. They are documented and people concerned informed and trained. Instructions, records, and training documents are filed in data bases.

### Safety, health and environment (SHE)

The environmental management is part of the SHE management system. The affinity of all three topics enables the definition of plant-wide uniform requirements and standards for many typical issues.

### Norfer Integriertes Management System (NIMS)

Under this system, experts for environment, work safety, quality, sustainability, risk management, data security and law coordinate all management issues plant-wide.



### Communication and relations

Active and prompt communication is essential to address environmental aspects that are often hardly perceivable and external requests. Meetings on all levels of ALUNORF's hierarchy are the central basis. SHE aspects are always high on the agenda. In addition expert groups for environment and safety are in place. For internal and external communication we have installed the environmental telephone (see imprint). Our environmental experts are in ongoing exchange with environmental authorities and trade associations.

## Internal audits – Rules are checked

Our rules are checked each year in internal audits (check of targets and actuals) by 20 well trained ALUNORF auditors. In annual refresher trainings we adapt the audit process and ensure that the audit results are implemented. The audits cover all activities at ALUNORF at least once every three years (Eco management and audit scheme). Our shareholders also audit our environmental impacts and environmental compliance. On the basis of findings and deviations found immediate, improvement and corrective actions are defined and implementation tracked.

## Responsible persons and environmental protection officers

For an overview of the environmental management system see the organisational chart below.

The technical managing director is responsible for environmental protection; he assumes the duties of plant operator acc. to the respective laws § 52b of Federal Immission Control Act (BImSchG), § 58 Act on Waste Management and Waste Disposal (KrWG) or § 3 Greenhouse Gas Emissions Trading regulation (TEHG).

The managing directors and department managers and other persons responsible for operations have been assigned the environmental tasks that both ensure the maintenance of our management system and ensure compliance with legal and regulatory requirements.

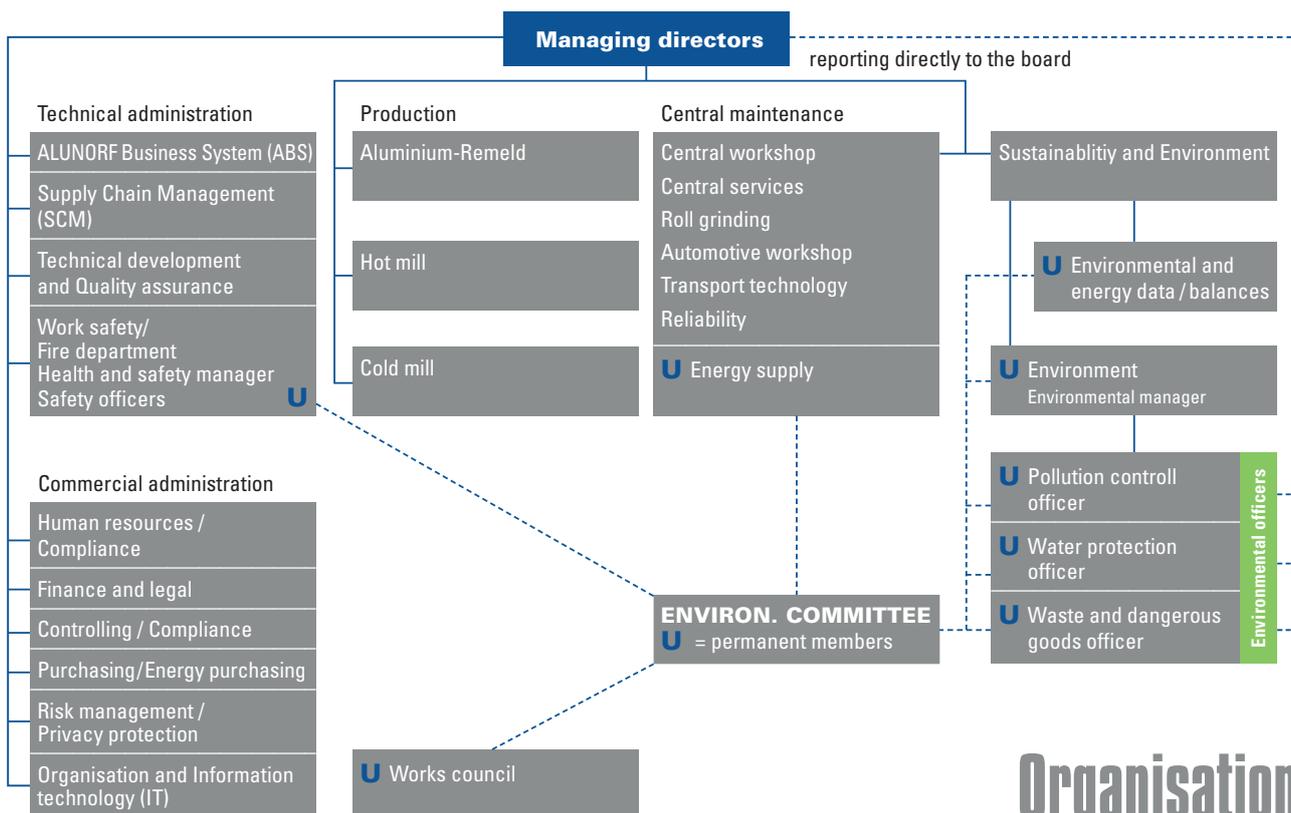
In the steering committee – „Safety, health and environment“ (EHS Steerco) – managers tackle current and systematic issues and agree on changes to ALUNORF's strategy if needed.

The Sustainability and Environment Department was newly established, into which the existing Environment Department will be integrated.

The head of the environmental department as the officially appointed environmental management officer coordinates the environmental management system. He monitors the implementation of our environmental policy, the assessment of environmental aspects, the definition of key performance indicators (environmental key figures), the fulfillment of environmental objectives and programmes on a regular basis and informs the managing directors on deviations.

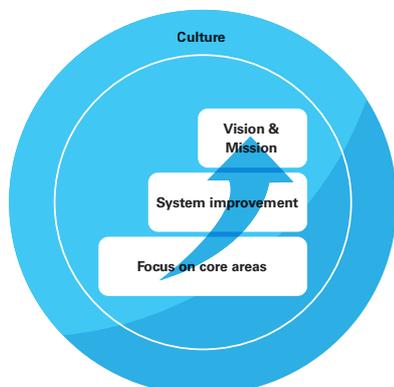
He is the contact for environmental authorities and initiates environmental permits as needed. Under his leadership the activities of the environmental officers are aligned. He chairs the environmental committee (participants see organisational chart).

The environmental protection officers counsel the managing directors and the individuals in charge of operational issues on all environmental topics that may arise; they control compliance to environmental issues.



# ALUNORF 2024 – It does not work without improvement

Sustainability – Decarbonisation – Aluminium Cycle



ALUNORF 2024 – Striving for the culture of lived responsibility

## „ALUNORF 2024“

With ALUNORF 2024, we have launched the programme with which we want to secure the future of the plant, even against the backdrop of economic risks against the backdrop of economic risks. All employees are called upon to systematically monitor and improve the performance of the processes. Above all, it is about involving employees in change. It is about responsibility. Because only if everyone is involved and contributes their knowledge and skills can we achieve our goal for 2024 and beyond. We want to develop an organisation where responsibility and co-creation can be lived at all levels.

## ALUNORF Business System

The „ALUNORF Business System“ („ABS“) is our way of making all processes along the entire value chain fit for the future and thus surviving in the global market and living up to our responsibility in the environmental and energy sector. „ABS“ covers all our processes. From an environmental point of view, the focus of our actions is on the fulfilment of legal operator obligations, the implementation of requirements from official permits, and action in emergency situations. „ABS enables us to continuously improve our processes and reduce losses through targeted improvement projects and specific key figures.

In our regular meetings at all hierarchical levels („TOP rounds“), our colleagues identify the strongest levers for reducing losses. We prefer to do fewer things and do them really well. At the centre of „ABS“ is the intensive involvement of employees in order to create space for lived responsibility and co-design at all levels.

Within the framework of „ABS“, we combine day-to-day business and improvement projects. The „lying eight“ (picture on the right) shows how both influence each other. The basic principles of „ABS“ are similar in many places to the approaches of the standards for management systems such as ISO 14001 for environmental management.

## Environmental Management and ABS

Together with the ABS team (cf. organisational chart p.33), Safety and Quality Management as well as the Sustainability and Energy Managers, we will push ahead with the further development of environmental management and the integration of the systems. This will be done carefully and step by step. Because here, too, what counts for us is the sustainable result.

We want a transparent management system that functions across all system



## Increasing the use of recycled metal in the remelt plant

The production of rolling ingots from recycled metal requires only about 5 % of the energy needed for primary metal and this without any loss of quality. Recycled metal is already being used today. This metal is mostly mixed with alloying metals of different contents. In order to further increase the proportion in the future, logistics and storage must be improved. The project to automate the batching process in the remelt plant (in-house: „BIS“) aims to achieve this.

After receiving official approval, the work was started in 2020. The necessary roofing of a rail unloading track was put into operation. We are also aiming to commission the first part of the metal reception soon. The project is to be completed in 2023 with the automatic operation of the solid metal warehouse.

Since 2019, the proportion of recycled metal used has been tracked as a key performance indicator. For 2021, we had set a target to increase the proportion of recycled materials in the cast ingots to over 50 %. Despite the adverse conditions for operations in pandemic times, this target was almost achieved (49 %).

While this has no impact on energy use at our site, it does reduce the energy used by upstream plants and thus the ecological footprint of the aluminium. And that is what it is all about in the end.

## What we want to improve

Environmental programme – our goals and projects



Ecological footprint



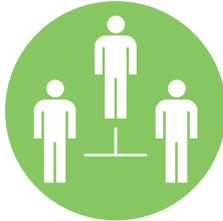
Natural gas



Air



Hazardous Substances



Organisation

Focus on the ecological footprint:

- better process efficiency in energy and CO<sub>2</sub>
- more recycled aluminium in the product

Increase sustainability and protect environment.

Energy

Environment



Cooling tower hygiene



Efficiency



Electricity



Water



Recovery / Circulation



Communication

The environmental programme summarises the current individual measures for improving the environment in the form of a catalogue. Each environmental target is allocated to an environmental theme (cf. coloured environmental symbols above). The measures are subdivided into the topics of energy or environment. Measurably defined, each environmental goal is identified by a number.

If no quantified target values are possible, the successful completion of the project is considered implementation.

With each environmental statement, we report on the status of the environmental programme. Completed measures from previous years are omitted from the

report, while new ones are added. The chronology is derived from the successive environmental statements.

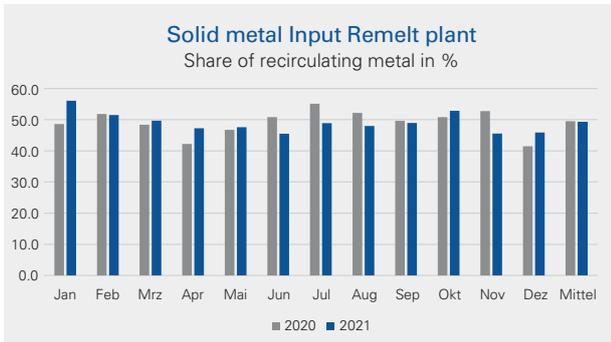
### Outlook

We want to continue to improve - also in the environmental sector. In this context, the measures that are easy to realise have already been mostly realised in previous years.

What is important is how we find new projects: To this end, we regularly carry out loss analyses and thereby find out the areas in which we can improve our procedures. Priorities are set annually in the „commitment process“. The projects are carried out on the basis of the ALUNORF business management system („perfect process“ approach).

In particular, the targets we have set ourselves in the area of climate protection will also require the use of new technologies not previously used on an industrial scale and intensive cooperation with research institutes and plant construction companies in the coming years.

Major changes depend on the availability of investment funds. In this context, we are also dependent on public funding for essential, innovative projects, in order to be able to handle projects that would jeopardise the profitability of the company on their own.



Subject Energy		Project data	State
Increase recovery of canbody stock by 3% (return of internal AI-scrap, base year 2016) Note: The recovery increase reduces the specific energy consumption	No. ⑤ ⌚ 📄	97 10 000 € 12/2019 ex. 12/2021 Contin. Improvement ΔCO <sub>2</sub> - 3.018 t *)	●
Improved control of the casting water cooling tower systems 2 and 4: Installation of a shutdown function per cooling tower cell (project) Note: The project aims at reducing the power consumption. Possible saving potentials can only be determined in the course of the project.	No. ⑤ ⌚ 📄	123 50 000 € 12/2022 Central maintenance	◐
Introduction of the „Energy Expert Community“ working group: Systematisation of idea collection and pursuit of promising ideas	No. ⑤ ⌚ 📄	125 1 000 € 12/2021 Energy manager, Energy purchase, Environm.	●
Avoidance of sawing at the ingot head by at least 50% of ingots for beverage cans: Reduction of blowholes (cavities/inclusions) in the cast ingot through optimization of the casting end phase on casting lines 11 to 13 Note: Improved yield reduces specific energy requirements of ingots	No. ⑤ ⌚ 📄	126 375 000 € 12/2021 Remelt	●
Reduction of ingot cracks: Investigation of process data for further improvement of the casting process for a crack-free sprue with Big-Data-methods (project) Note: Improved yield reduces specific energy demand of ingots	No. ⑤ ⌚ 📄	127 10.000 € 12/2021 Remelt	●
Increasing throughput at the soaking pit: process analysis of furnace occupancy with Big Data-methods to identify optimization potential (project) Note: Optimization of the scheduling can reduce the specific energy requirement for preheating the ingots	No. ⑤ ⌚ 📄	128 10 000 € 12/2021 Hot mill	●
Increasing the rolling strip yield of automotive sheet: process analysis of the rolled strip yield using Big Data-methods to identify optimization potential (project). Note: Improved yield reduces specific energy requirement of the coils	No. ⑤ ⌚ 📄	129 10 000 € 12/2021 Cold mill	●
Reduction of electricity requirements: Analysis of about 160 heat exchangers in the cooling tower system 1.1 with regard to control optimization (Project) Note: Demand-driven control is intended to improve the regulation of the cooling water volume flow, thus reducing the power requirement.	No. ⑤ ⌚ 📄	130 10 000 € 12/2022 Central maintenance	◐
Reduction of energy demand in the preheating of rolling ingots: New construction and operation of soaking pits chambers 21 and 22 to replace the existing chambers 21 to 23 (project); reduction of specific energy consumption in kWh/mt by 15% (annual sum of natural gas and electricity, base year 2019)	No. ⑤ ⌚ 📄	139 11 300 000 € 12/2024 Hot mill ΔCO <sub>2</sub> - 2.154 t *)	◐
Development of improvement potentials in the field of energy: Participation of technical trainees in the energy scout programme of the Chamber of Industry and Commerce (project)	No. ⑤ ⌚ 📄	140 1 000 € 12/2022 Human Resources	○
Development of improvement potentials in the field of energy: Visualisation of the current and expected power consumption in a control stand of a cold mill (project)	No. ⑤ ⌚ 📄	141 10 000 € 12/2023 Cold mill	○
Development of improvement potentials in the field of energy: Study on the possible conversion of the combustion air preheating of all remelt furnaces with recuperator technology (project). Determination of possible alternative technologies and the savings potentials.	No. ⑤ ⌚ 📄	142 10 000 € 12/2022 Remelt	○

\*) Planned reduction of CO<sub>2</sub> amount in t/a; emission factors: electricity 0.67 kg/kWh and natural gas 0.183 kg/kWh.



Soaking pits



Burner equipment anneling furnaces



Automation charging process remelt furnaces (BIS)

Subject Environm. + Substances      		Project data	State
Reduction in the use of solid metal of primary aluminium: Improvement of the storage and charging of aluminium cycle metal at remelt furnaces 1 to 13 by automated aggregates and processes (Project „BIS“) Note: Project increases use of recycled metals and indirectly reduces greenhouse gases	No. € 🕒 🏭	120 22 300 000 € 02/2023 Remelt	 
Reduction of hydraulic oil consumption at cold mill 3 by 50 %: Functional improvement of the valve blocks and optimisation of the maintenance possibilities at the 180 bar hydraulic system	No. € 🕒 🏭	121 10 000 € 12/2021 Cold mill	 
Reduction of dross quantity to increase the yield of the recycling furnaces: Investigation of the melting and drossing process to determine improvement possibilities by means of Big Data-methods (project)	No. € 🕒 🏭	131 10 000 € 12/2021, extended until 12/2023 Remelt	 
Increasing resource efficiency in ingot production: Feasibility study for a 3rd recycling furnace to increase the recycled metal content (project)	No. € 🕒 🏭	132 10 000 € 12/2021 Remelt	 
Reduction of material losses by 10% (base: 2020): Improvement of the plant tightness of selected hydraulic and lubricating oil systems at hot mill 1	No. € 🕒 🏭	133 10 000 € 12/2021, extended until 12/2022 Hot mill	 
Reduction of material losses by 30% (base: 2020): Improvement of the plant tightness of selected hydraulic and lubricating oil systems on the slitter 6	No. € 🕒 🏭	134 10 000 € 12/2021 Cold mill	 
Reduction of noise and air pollutants: Conversion of 5 company cars to gasoline plug-in hybrid vehicles and installation of charging stations on the plant premises.	No. € 🕒 🏭	135 6 000 € (Charging stations) 12/2021 Central maintenance	 
Reduction of solid metal input from primary aluminium in rolling ingot production: Construction and operation of a 3rd recycling furnace for remelting additional aluminium recycled metal (project RC3). Note: Project increases use of recycled metal and reduces greenhouse gases indirectly	No. € 🕒 🏭	136 18 000 000 € 12/2024 Remelt	 
Reduction of waste water from the casting process of the rolling ingots: Expanding the water treatment, among other things, for the make-up water of the casting water cooling circuit systems 2 and 4 with two reverse osmosis stages; reduction of waste water volume of the Sewage plant Flotation by 10 % per year (base 2020).	No. € 🕒 🏭	137 2 100 000 € 12/2024 Central maintenance	 
Reduction of material losses by 30 % (basis: 2021): Improvement of the system tightness of selected hydraulic and lubricating oil systems on the slitter 6	No. € 🕒 🏭	138 10 000 € 12/2022 Cold mill	 

Degree of completion:  0 %  25 %  50 %  75 %  100 %

# What goes in and out

## Input-Output-Balance 2019 - 2021

INPUT	2019		2020		2021	
	absolute 1 526 345	related on shipment <sup>1)</sup>	absolute 1 367 242	related on shipment <sup>1)</sup>	absolute 1 480 537	related on shipment <sup>1)</sup>
Reference Shipment volume <sup>1)</sup> in t:						
<b>Raw material</b>	t	kg/t	t	kg/t	t	kg/t
Solid Aluminium	495 480	325	449 401	329	469 537	317
Molten Aluminium	63 544	42	89 632	66	90 561	61
Alloy components	16 467	11	13 972	10	12 765	9
Sheet ingots (foreign ingots)	1 018 804	667	875 712	640	975 852	659
<b>Energy</b>	Mill. kWh	kWh/t	Mill. kWh	kWh/t	Mill. kWh	kWh/t
Electricity	638	418	602	440	638	431
Natural gas <sup>11)</sup>	1 413	926	1 315	962	1 391	939
Diesel	15	10	13	10	14	9
<b>Total</b>	<b>2 066</b>	<b>1 354</b>	<b>1 930</b>	<b>1 412</b>	<b>2 042</b>	<b>1 380</b>
<b>Process materials</b>	t	kg/t	t	kg/t	t	kg/t
Oils and additives	3 866	2.53	3 828	2.80	3 876	2.62
Chlorine	176	0.12	162	0.12	169	0.11
Acids and alkalis	1 511	0.99	1 375	1.01	1 387	0.94
Hydrate of lime	378	0.25	387	0.28	343	0.23
Filter earth	641	0.42	594	0.43	731	0.49
Aktive coke	74	0.05	43	0.03	44	0.03
Refrigerant	0.30	0.00	0.21	0.00	0.27	0.00
Inert gases (nitrogen and argon) <sup>12)</sup>	1 938	1.27	1 868	1.37	2 747	1.86
Biocides <sup>8)</sup>	82	0.05	68	0.05	121	0.08
<b>Water</b>	m <sup>3</sup>	m <sup>3</sup> /t	m <sup>3</sup>	m <sup>3</sup> /t	m <sup>3</sup>	m <sup>3</sup> /t
Drinking water	43 765	0.03	47 610	0.03	50 955	0.03
Ground water sumption <sup>9)</sup>	1 429 448	0.94	1 428 981	1.05	1 517 197	1.02
- thereof used in plant	1 330 153	0.87	1 341 621	0.98	1 436 075	0.97
Rain water <sup>7)</sup>	316 250	0.21	270 296	0.20	356 408	0.24

In an Input-Output balance all annually incoming substance-/material- and energy volumes are compared to the outgoing ones. The absolute volumes are shown compared to the last 3 years; in addition the calculated values based on one ton of shipped sheet – total hot and cold <sup>1)</sup>.

Related values are specific values also named key performance indicators. Environmental key performance indicators are used for the definition of targets. Improvement of environmental key performance indicators are named environmental performance and controlled by environmental key performance indicators only.

The values 2019 - 2021 are listed in the above table. The specific values include the required KPI for energy, air pollutants, waste water and waste.

OUTPUT	2018		2019		2020	
Reference	absolute	related on	absolute	related on	absolute	related on
Shipment volume <sup>1)</sup> in t:	1 526 345	shipment <sup>1)</sup>	1 367 242	shipment <sup>1)</sup>	1 480 537	shipment <sup>1)</sup>
<b>Products/AL-By-products</b>	<b>t</b>	<b>kg/t</b>	<b>t</b>	<b>kg/t</b>	<b>t</b>	<b>kg/t</b>
Sheet ingot	13 860	9	11 570	8	15 853	11
Hot band <sup>1)</sup>	291 881	191	244 490	179	259 403	175
Cold band <sup>1)</sup>	1 234 464	809	1 122 752	821	1 221 134	825
Dross/Scalper chips <sup>2) 10)</sup>	66 125	43	60 423	44	51 890	35
<b>Greenhouse-/Exhaust gases</b>	<b>t</b>	<b>kg/t</b>	<b>t</b>	<b>kg/t</b>	<b>t</b>	<b>kg/t</b>
Carbon dioxide indirect <sup>4)</sup>	427 692	280.21	403 211	294.91	427 141	288.50
Carbon dioxide direct <sup>5)</sup>	258 616	169.43	240 642	176.01	254 522	171.91
Carbon dioxide eq. total <sup>6)</sup>	698 288	457.49	655 437	479.39	691 166	468.19
Nitrogen oxide	579	0.38	535	0.39	582	0.39
Carbon monoxide	403	0.26	378	0.28	401	0.27
Hydrocarbons	401	0.26	366	0.27	441	0.30
Dust	37	0.02	36	0.03	37	0.02
Chlorine and chlorides	8	0.01	8	0.01	7	0.00
<b>Waste/recyclables</b>	<b>t</b>	<b>kg/t</b>	<b>t</b>	<b>kg/t</b>	<b>t</b>	<b>kg/t</b>
<i>Hazardous waste</i>	7 004	4.59	6 643	4.86	8 693	5.87
- thereof recycled	5 113	3.35	5 172	3.78	5 035	3.40
- thereof disposed of	1 891	1.24	1 471	1.08	3 658	2.47
<i>Non-hazardous waste</i>	8 769	5.74	8 194	5.99	7 882	5.32
- thereof recycled <sup>10)</sup>	8 769	5.74	8 194	5.99	7 882	5.32
- thereof disposed of	0	0.00	0	0.00	0	0.00
Refrigerant <sup>3)</sup>	0.51	0.00	0.04	0.00	0.05	0.00
<b>Waste water</b>	<b>m<sup>3</sup></b>	<b>m<sup>3</sup>/t</b>	<b>m<sup>3</sup></b>	<b>m<sup>3</sup>/t</b>	<b>m<sup>3</sup></b>	<b>m<sup>3</sup>/t</b>
Biological sewage plant	264 529	0.17	259 338	0.19	257 420	0.17
Storm water basin <sup>9)</sup>	617 125	0.40	549 779	0.40	629 763	0.43
<b>Waste water content:</b>	<b>t</b>	<b>g/t</b>	<b>t</b>	<b>g/t</b>	<b>t</b>	<b>g/t</b>
- Total organic carbons (TOC)	2.67	1.75	2.25	1.65	2.89	1.93
- Nitrogen compounds (N, total)	4.61	3.02	4.00	2.93	4.09	2.76
- Phosphorus compounds (P, total)	0.36	0.24	0.38	0.28	0.34	0.23
- Organ. Halogens compounds (AOX)	0.05	0.03	0.04	0.03	0.03	0.02

1) Shipment is sum of hot and cold band without sheet ingot

2) Dross from remelt with high Al content (not considered under waste/recyclables)

3) Delivered to specialized firms for recycling

4) Carbon dioxide (CO<sub>2</sub>) indirectly from electricity use (main source, emission factor 0.67 kg CO<sub>2</sub>/kWh); Grid mix 2020: 47.6 % coal, 24.4 % nuclear, 23.7 % natural gas, 1.6 % renewable energy and 2.6 % other fossil fuels combined. Concerning the environmental impact additional data are given: radioactive waste 0.00066 g / kWh, CO<sub>2</sub> emissions 0.59 kg/kWh.

5) Carbon dioxide (CO<sub>2</sub>) directly from natural gas consumption (main source), calculated from consumption, calorific value and emission factor 0.183 kg CO<sub>2</sub>/kWh Ho.

6) Greenhouse gas equivalent: CO<sub>2</sub> direct and indirect all sources at location in Neuss (Scope 1 + 2), emission factor electricity 0.67 kg CO<sub>2</sub>/kWh, values 2019 and 2020 adjusted (Scope 3 arrival/departure of employees deducted).

7) Calculated from annual rain water in l/m<sup>2</sup> and sealed surface in m<sup>2</sup>.

8) Consumption to ensure cooling tower hygiene (a. o. legionella), contains input materials for two biocide generators; from 2021 new at cooling tower 4.

9) Dewatering on ALUNORF premises is part of ground water protection, varies acc. to needs and is discharged through purification plant for rain water

10) Ratio of separate collection acc. to Regulation on Commercial Waste exceeds stipulated 90%.

11) District heating supply 28.5 mill. kWh in 2021; 2.0 % of natural gas use

12) Additional quantity in 2021 due to technical problems in the air separation plant

# Declaration

The Environmental Statement 2022 of ALUNORF is the completely revised version in the three-year cycle 2022 to 2024. It was submitted to the accredited environmental verifier Dr. Ulrich Hommelsheim for validation. In parallel, the certificate monitoring according to ISO 14001:2015 took place.

We conduct comprehensive internal environmental audits every year and ensure that each area and all activities are audited at least once in a three-year cycle. Together with the updated list of relevant environmental impacts and the facts and figures from the previous year, the audit reports form the basis of a management assessment to review the environmental strategy (environmental policy according to EMAS), the environmental management system and the continuation of our goals in the environmental programme.

Our environmental strategy has been completely revised (p.14/15). The environmental management system does not currently require any changes to its content.

The current presentation of our targets is part of this Environmental Statement 2022.

In this Environmental Statement 2022, we have presented the activities for compliance with legal regulations, including in particular the regulations on immission protection, water management, circular economy and energy law, on a topic-by-topic basis.

This consolidated environmental statement 2022 will be updated in 2023 and 2024. All versions will be validated by an environmental verifier and published. The consolidated environmental statement 2025 will be published within three years.

We are committed to the sustainable development of ALUNORF as an aluminium semi-finished product producer in accordance with the requirements of the „Aluminium Stewardship Initiative“. We are certified according to the standard every 3 years, the last time successfully in 2021.

Neuss, February 18, 2022



Michael Adrian Wälchli  
Technical managing director



Dipl.-Ing. Oliver Hommel  
Commercial managing director



Dr. Ing. Klaus Werner Döhl  
Environmental manager

# Excellent

## Aluminium Stewardship Initiative (ASI)

„ASI“ is the first global industrial sustainability standard for metal production. Certified companies have committed themselves to compliance with sustainability criteria in terms of ecology (environmental protection), social issues and proper corporate governance.

Manufacturers, processors and stakeholders throughout the aluminium value chain are expected to contribute to a sustainable society. Together, we ensure responsible production, procurement, management and supply of aluminium.

Aluminium is an indispensable component of many system-relevant products in Corona times and definitely necessary for many applications in the future. Aluminium supplied by ASI-certified producers such as ALUNORF can be certified as metal if all parties involved in the product meet the ASI standards („Chain of Custody“). We contribute to this.



Certificate 2021  
„Aluminium Stewardship Initiative“ (ASI)

## Validation statement

The environmental verifier listed below confirms to have verified that the site, as indicated in the present environmental statement of the organisation Aluminium Norf GmbH with registration number DE-137-00016, complies with all requirements of Regulation (EC) No.1221/2009 of the European Parliament and of the Council of 25 November 2009 as amended on 28 August 2017 and 19 December 2018 on the voluntary participation by organisations in a Community ecomanagement and audit scheme (EMAS).

Name of the environmental verifier	Registration number	Approved for the sectors (NACE)
Dr. Ulrich Hommelsheim	DE-V-0117	24.42 Aluminium production

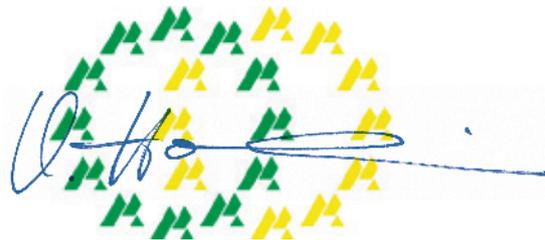
With signing this validation statement it is confirmed that:

- Verification and validation were conducted in full compliance with requirements acc. to Regulation no. (EG)1221/2009 as modified by Commission Regulation (EU) 2017/1505 and by Commission Regulation (EU) 2018/2026
- The result of the audit and validation confirms that there is no evidence of failure to conform to the valid environmental regulations.
- Data and facts of the environmental statement of Aluminium Norf GmbH convey a reliable, credible and true picture of all activities.

This validation statement cannot be compared to a registration according to EMAS. EMAS registrations are conducted by bodies according to Regulation no. (EG) 1221/2009. This statement must not be used as document of its own right for information of the interested public.



Neuss, February 18, 2022



Dr. Ulrich Hommelsheim  
Environmental verifier  
(DE-V-0117)

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The environmental statement declared valid was filed with the registration office at Internal Chamber of Industry and Commerce Duisburg. The application for continued listing in the EMAS register of EU was successfully confirmed by the new certificate valid until May 17, 2025.

# Glossary

## Airpure process

Process for cleaning exhaust air from cold mills. Oil droplets and gaseous oil components are enriched in a washing oil. The wash oil/rolling oil mixture is separated again in a distillation unit. The main advantage of the Airpure process is the recovery of the rolling oil. The process was developed at ALUNORF in the 1970s, patented and is used worldwide today.

## Sheet ingot

Rectangular aluminium blocks to be further processed by rolling; at ALUNORF up to 32 t weight.

## CHP

Abbreviation for combined heating and power generation unit. In a CHP electricity and heat are generated in a combined manner by use of fuels. ALUNORF uses natural gas motors as CHP, which not only generate heat and power, but also process the waste gas in order to use it as a protective gas in the annealing furnaces (Heat, Power and Material coupling).

## Biocides

Chemicals (or micro organisms) for pest control. ALUNORF uses biocides in emulsion and cooling tower systems. Since ten years no biocides have been added in our emulsion systems. In the cooling tower systems we have to use biocides regularly in order to avoid legionella.

## CO<sub>2</sub>

Carbon dioxide; gaseous product from burning, by approx. 0.04 % contained in the natural atmosphere. CO<sub>2</sub> equivalents are GHG releases of other substances that for better comparison of their effects are recalculated to CO<sub>2</sub>. Factors are agreed internationally.

## Coil

Rolled up aluminium strip (up to 30 t weight at ALUNORF).

## EMAS

Abbreviation for the European regulation about voluntary participation of organisations in the European system for environmental management and environmental audit.

## Emission

Release of foreign substances into the environment (mainly air pollutants into the atmosphere).

## Emulsion

Finely dispersed mixture of two immiscible liquids (here oil and water) without visible demixing. In industrial applications emulsions are used as as coolant for mechanical metal forming.

## Immission

Impact of the emission in the vicinity of the emission source (e.g. concentration in the breathing air).

## Dross

Slag that floats on top of the molten aluminium, which is removed from the surface. Dross mainly contains metallic aluminium.

## kW

Kilo Watt: Unit to express the output power.

## Pig/Sow

Aluminium pieces cast into special shapes; used in remelt.

## NO<sub>x</sub>

Gaseous oxides of nitrogen arise during the combustion at very high temperature. NO<sub>x</sub> acts acidifying and plays a role in the formation of smog.

## Slab

Long, thick aluminium plate generated in breakdown mill from sheet ingots (intermediate); is rolled down to strip in the finishing mill (wound up in coils).

## Recuperator

Device to preheat the combustion air by means of heat from the waste gas. The waste gas flows around the tubes, the combustion air flows through the tubes. The higher the temperature reached the combustion air, the lower the energy consumption of the respective furnace. Usual combustion air temperatures is 300-500 °C.

## Regenerator

Device to preheat the combustion air by means of heat from the waste gas. The exhaust gas flows around ceramic material and heats it. Subsequently, the combustion air is passed and heated over the hot material. The higher the temperature reached the combustion air, the lower the energy consumption of the respective furnace. Usual combustion air temperatures are up to 1000 °C. Therefore, the energy use in regenerator furnaces is lower by 10-30% than recuperative furnaces.

## Reliability

Reliability through stable and predictable processes. Target: A process works like this, as we want, whenever we want it! Long-term project to improve all processes within the company.

## Standard tonne an equivalence factor

The standard tonne (ST) is a measure of the rolling performance / production quantity compared to a standard product as a reference. If a higher processing time is required for a product, e.g. with a lower rolling speed or additional rolling operation, more standard tonnes are therefore also produced, although the pure mass of the product in metric tonnes remains unchanged.

Dividing the ST by the metric tonnage results in the equivalence factor (AZ), which has the value „1“ for the standard product. Numerical values above 1 mean an additional effort.

## Edger

The edger is in front of the breakdown of hot rolling (2 rolls with a vertical axis). It is intended to prevent the slab growing during rolling in the width.

## Crucible

Vessels for receiving hot liquids, which are lined with ceramic materials. At ALUNORF crucibles are used to transport liquid metal.

## Imprint

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### Responsible for this environmental statement:

Herr Dr. Klaus Werner Döhl

Head of energy and environmental department in his function as environmental management officer.

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