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New steel projects bewilder producers

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The total designed capacity of the domestic cold-rolled steel industry reached more than 700,000 tonnes, so local producers now can only run at about half of their designed capacity, according to the petition.">

The total designed capacity of the domestic cold-rolled steel industry reached more than 700,000 tonnes, so local producers now can only run at about half of their designed capacity, according to the petition.

As the domestic stainless steel production capacity far outweighs the actual demand, the Mekong Delta province of Tien Giang's decision to approve the cold-rolled stainless steel project by two Chinese investors, after it was rejected at least twice in the southern province of Dong Nai, is causing local steelmakers a great deal of concern and drawing calls to tighten the licensing of new steel projects.

A series of local steel producers have submitted a petition for urgent review to the Government Office and related ministries on the new cold-rolled stainless steel project in Vietnam.

This project is invested by Foshan Union Stainless Co., Ltd. and Zhejiang Yongjin Metal Technology Co,. Ltd. (Yongjin Metal) in Tien Giang, laying out a blueprint for a facility with an annual capacity of 250,000 tonnes of cold-rolled stainless steel.

The document noted that this is an example of the company going around one province's refusal to get an investment certificate in another in Vietnam According to the petition, China-based Yongjin Metal applied for an investment certificate in Dong Nai to build a stainless steel project in April 2017 and August 2018, but it was rejected due to the local authorities' growing concern of oversupply and environmental pollution.

"However, only eight months after receiving the Dong Nai decision refusing to issue an investment certificate on August 23, 2017, Yongjin Metal received the permit for this project in another province. Stainless steel producers are surprised and confounded by this," the petition stated.

Nghiem Xuan Da, chairman of the Vietnam Steel Association (VSA), suggested that, "The authorities of the provincial industrial zones should consult the central authorities as well as the relevant associations when licensing new investment projects in order to avoid supply--demand imbalances as well as trade disputes between nations. It is imperative to consider many factors when adopting a new steel project."

Dr. Phan Huu Thang, former director of the Foreign Investment Agency under the Ministry of Planning and Investment, said that a database on foreign direct investment (FDI) is being built and information flows will not be completely smooth until the system is completed.

The total designed capacity of the domestic cold-rolled steel industry reached more than 700,000 tonnes, so local producers now can only run at about half of their designed capacity, according to the petition.

The local demand for stainless steel will continue to be met with an oversupply of 229,000 tonnes up until 2021, according to global market analysis by CRU Group calculated on the assumption of 8.4 per cent positive average growth per year.

According to the VSA, it is hard to export cold-rolled stainless steel as there are many large manufacturers in Southeast Asia and the regional supply exceeds the demand. It is also difficult to export steel to the US and EU markets which apply anti-dumping policies to steel products.

“The domestic stainless steel market has been hit hard by the influx of Chinese products. If more new investors are involved, it will be only a matter of time until the market collapses,” said a steel expert, adding that continuing to attract investment into cold-rolled stainless steel will create fierce competition among producers and reduce their investment efficiency.

China, the world’s largest steel producer, has experienced years of plunging prices and factory shutdowns due to oversupply.

The Chinese government has shut down steel plants with the total capacity of over 90 million tonnes over the past five years and plans to reduce steel output by 100 million tonnes to 150 million tonnes by 2020 to ease the supply and demand imbalance.

Thus, Chinese steel producers are moving to set up operations abroad, including in Vietnam, and have even agreed to sell their output at a loss to win more orders and cover their fixed operating costs.

The concerns have not stopped here, as many countries are using anti-dumping measures against Chinese steel products as well as goods of covered-up Chinese origin.

Tightening new projects

The VSA suggested that international investors should not be invited to produce normal steel products that are in oversupply in the country. Instead, they should be encouraged to invest in the production of alloys and high-quality steel.

Besides, with the government’s reluctance to trade off environmental integrity for economic growth, many provinces should be cautious about steel projects, with some even rejecting new steel investment proposals.

“If Vietnam is as determined to protect the environment as it claims, clean projects will come. After tightening the licensing, the quantity may be less, but the quality will be better,” economist Pham Chi Lan said.

In the same way, Tran Vietnam Ngai, chairman of the Vietnam Energy Association stressed that the steel industry is a particularly energy-intensive sector. Thus, any new steel projects must avoid having significant negative impacts on the national power grid.

Besides, to curb the influx of cheaper imports and help local producers, a number of markets have slapped high anti-dumping duties on stainless steel from China, including India, Brazil, Thailand, the EU, and the US.

The VSA warned foreign investors against investing in factories in Vietnam with the targets of avoiding Vietnam's anti-dumping taxes and avoiding anti-dumping export duties.

Lessons from the past

Reminding of past issues when Vietnam witnessed the rampant development of power-hungry steel plants, Pham Chi Cuong, former chairman of the VSA, warned that, "The lessons are relevant to this day, especially as the Ministry of Industry and Trade (MoIT) is no longer responsible for planning in industries like steel."

In 2010, the Vietnamese steel sector witnessed a grievous surplus due to its failure to conform with the planning, with over 30 steel projects licensed beyond the official master plans for the industry. Together, these projects added 60 million tonnes of extra annual capacity to the industry and are a direct result of inadequate regulation and lax local authorities' management.

Before, in 2007 and 2008 alone, dozens of billion-dollar steel projects, both domestic and foreign, were licensed. These included the $1 billion Tycoon-E.United Dung Quat steel complex in the central province of Quang Ngai with the annual capacity of three million tonnes in its first phase, the $4 billion Van Phong steel complex in the central province of Khanh Hoa.

The MoIT's inspection later found that of the 65 steel projects with an annual capacity of 100,000 tonnes or higher each, only 17 were included in the planning and 16 were approved by the ministry while the remaining 32 projects were licensed by provinces outside of the planning, with as many as 24 licensed ultra vires.

The southern province of Ba Ria-Vung Tau had the most steel projects across the country with the total annual capacity of 3.75 million tonnes of refined steel and over 10 million tonnes of rolled steel. Half of these projects were outside the planning.

Others with unplanned projects included the northern port city of Haiphong with five projects, the central province of Thanh Hoa and the northern province of Hai Duong with four each, the central province of Ha Tinh with three, and the northern provinces of Quang Ninh and Ha Nam with one project each already in operation.

This unchecked licensing fiesta has led to the crippling surplus where supply exceeds demand by 50 per cent. Since then the surplus has become worse despite an annual 10 per cent growth in the domestic demand. VIR

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Affected by the epidemic, Vietnam Yongjin's "annual production capacity of 250000 tons of precision stainless steel strip project" is scheduled to be put into production in March 2022._SMM

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Affected by the epidemic, Vietnam Yongjin's "annual production capacity of 250000 tons of precision stainless steel strip project" is scheduled to be put into production in March 2022.

Jan 10, 2022 03:56

[affected by the epidemic, Vietnam Yongjin's "annual production capacity of 250000 tons of precision stainless steel plate and strip project" is scheduled to be put into production in March 2022. Yongjin shares said: Vietnam Yongjin's "annual production capacity of 250000 tons of precision stainless steel plate and strip project." due to the great impact of the epidemic on the entry and exit of shipping and installers, the overall progress has been slightly delayed. All the equipment has arrived in Vietnam in October 2021, and most of the main equipment has been installed. If all goes well, the project is expected to be put into trial production by the end of March this year.

Recently, some investors asked on the interactive platform: Hello, Dong Mi, affected by the new round of epidemic situation, may I ask whether the construction of the Yong Jin construction project in Vietnam mentioned in the September investor research report of the company has been completed? Can it be put into production on schedule?

Yongjin shares said: Hello, dear investors, Vietnam Yongjin "annual production capacity of 250000 tons of precision stainless steel plate belt project", due to the epidemic on shipping, installation personnel entry and exit impact, the overall progress has been slightly delayed.

All the equipment has arrived in Vietnam in October 2021, and most of the main equipment has been installed. If all goes well, it is expected that the project will be put into trial production by the end of March this year. Thank you for your attention!

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Tsingshan Indonesia shakes up stainless steel markets in South East Asia

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Wood Mackenzie 15 July 2019

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News Release

The move is having a measurable impact on the company’s competitors

Shockwaves from Tsingshan's new stainless steel hub in Indonesia are reverberating across South East Asia and beyond, according to Wood Mackenzie.

“Competitively priced exports of Indonesian stainless product have provoked varying reactions from stainless steelmakers in the destination countries. China has warned off Tsingshan with anti-dumping duties, Taiwan has willingly taken Indonesian stainless instead of melting its own, South Korea is changing its mix of stainless grades and fighting a proposal for a new Tsingshan cold rolling (CR) mill, India is partnering with Tsingshan in a new CR venture that is about to enter production and Europe is worried that more Indonesian stainless might come its way,” said Sean Mulshaw, Wood Mackenzie Principal Analyst.

Tsingshan upsets the apple cart

Tsingshan's stainless complex in Morowali, Indonesia, entered production in mid-2017 with a capacity of 2Mtpa. In 2018, this was increased to 3Mtpa. A third line was commissioned but has yet to start commercial operations.

“Normally, the start up of a new 3Mtpa stainless melt shop would be good for nickel demand and generally positive for prices. In this case, however, the ramp up in production has been partly offset by cuts in output elsewhere, with more likely to follow.

“The Morowali mill is regarded as the lowest cost stainless operation in the world, primarily due to its integration with, and hot metal transfer of, nickel pig iron (NPI). Its stainless semi-finished products of slab and hot-rolled coil (HRC) are both very competitively priced. As a result, global producers are likely asking: why continue to melt stainless when I can purchase these lower priced semis and roll them instead?” added Mr. Mulshaw.

China closes the door

When Tsingshan started up the Morowali stainless complex in July 2017, output was principally shipped to China. By the end of March 2018, almost 1Mt of stainless steel slab and HRC had been exported to the country, however the market was not strong enough to absorb it.

“Inventories increased to record levels, the Chinese market weakened and Tisco, one of Tsingshan's main competitors, lobbied the government to take action. Threats of anti-dumping measures were made and Tsingshan duly backed off, cutting production at its own mills in China and expanding its customer base in other South East Asian countries.

“The Chinese government followed through on its threat of anti-dumping duties. On 23rd March 2019, it introduced preliminary tariffs against Indonesia, South Korea and Europe. This triggered a repeat of the early-2018 oversupply situation, as Tsingshan increased its stainless exports to China in the period immediately leading up to the duty instigation date. This, combined with strong domestic production in March and into Q2, drove inventories back up to record highs,” said Mr. Mulshaw.

Taiwan embraces the change

Since Tsingshan's Indonesian stainless became available, Taiwan has been cutting domestic melt production.

Between November 2017 and March 2019, Taiwan imported 560kt of Indonesian stainless slab and HRC. As a result, from July 2018, Taiwan's own melt shop - of which Yusco is the largest – decided to reduce production by an average of 40kt per month. This is the equivalent of almost 500ktpa.

“The melt shop is the most expensive element of stainless steelmaking operations, therefore this strategy is reducing costs for Taiwanese mills. At the same time, iron-nickel inventories have doubled. In addition, since the beginning of 2019, Taiwan's mills have increased stainless steel scrap imports considerably, further lowering their primary nickel requirements. These changes equate to a cut in primary nickel consumption in stainless of about one third, from 46kt in 2017 to an estimated 31kt in 2019.

“Stainless imports from Indonesia have also replaced imports from other countries, most noticeably China and South Korea. These two countries accounted for almost 90% of stainless HRC imports in 2017, however this share approached 60% in 2018 and will sit at approximately 50% in 2019,” added Mr. Mulshaw.

South Korea resists

When looking at South Korea, imports from China, Taiwan and Japan are being replaced by imports from Indonesia.

“While domestic output of the country's main producer, Posco, has not been greatly affected in terms of quantity, it has instigated a change in product mix. In January 2019, the company stated that its efforts to combat the Tsingshan threat would be two-fold: to produce more ferritic and high chrome grades of stainless that Tsingshan does not make in Indonesia; and to produce a low-cost stainless product that would directly compete with Tsingshan's 304 grade.

“There is now an added threat from Tsingshan's stainless cold-rolled coil (CRC). Tsingshan has reportedly submitted a letter of intent to the Busan city government for a new 600ktpa stainless CR mill. The Korean Iron and Steel Association (KoSA) opposed the motion. Korea's cold rollers may be happy taking cheaper HRC from Indonesia in preference to the semis previously obtained from Posco, however a new CR mill fed by that same low-priced HRC would undoubtedly take market share from them too,” said Mr. Mulshaw.

India partners up

Tsingshan has intensified its stainless HRC shipments to India in preparation for the July start up of its new 600ktpa CR mill at Mundra, Gujarat.

“This could spell trouble for Jindal Stainless. The company owns India's two largest flat rolling mills, both of which had disappointing sales of stainless products in 2018-2019. During the first week of July, India's Ministry of Commerce and Industry announced that it would launch an anti-dumping investigation of stainless flat products from 15 countries, including Indonesia, China, South Korea, Taiwan and Japan. The investigation was

triggered by appeals from the Indian Stainless Steel Development Association (ISSDA) and three subsidiaries of Jindal Steel and Power, including Jindal Stainless (Hisar)," said Mr. Mulshaw.

European mills expected to struggle

In 2015 to 2017, EU27 imports of stainless steel from Indonesia amounted to an average of approximately 3kt per quarter, though this increased to more than 20kt per quarter in 2018 and 30kt in Q1 2019. The Indonesian share of imports has increased from less than 1% in 2015 to 2017 to 4.4% in 2018 and 10% in Q1 2019.

"In 2018, the U.S. 232 tariffs redirected considerable quantities of stainless away from the U.S. to Europe. Preliminary safeguarding measures brought in by the European Commission failed to mitigate effectively against this. As such, 2018 was a boom year for imports leading to stainless oversupply and high European stocks. The safeguards only began to have a noticeable impact from Q4, as illustrated by substantially reduced imports during that quarter. Definitive safeguards came in in January 2019 and these are functioning more effectively, as country by country quotas have provided import restraint. Indonesia is not limited by its own quota because it was not shipping any stainless to Europe between 2015-2017. This is why Indonesia is seen as a particular threat.

"European mills cannot afford to face a renewed challenge from Indonesian imports, especially with production levels sharply down on last year," said Mr. Mulshaw.

What will Tsingshan do now?

In 2018, Tsingshan shipped 950kt stainless slab and HRC to China. This now has to be shipped elsewhere, yet only 800kt of product was exported to alternative destinations.

"Agreeing new offtakes for such a large quantity of stainless will not be a quick process. Shortly before the anti-dumping instigation date, around 200kt went to China. If Tsingshan's new CR mill in India comes online in July, perhaps a further 300kt can go there. That leaves 450kt of other stainless that needs to be exported somewhere.

"If customers are not found then Tsingshan may have to cut production in Indonesia. This is counter to market expectations, with the start up of the third 1Mtpa line expected in H2 2019. However, producing more stainless will only add to the offtake challenge. For that reason, we expect the start up of the third line to be deferred until, at the very earliest, 2020," concluded Mr. Mulshaw.

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Are anti-circumvention actions now coming against EU stainless steel? – Stainless Espresso

steelnews.biz/anti-circumvention-coming-against-eu-stainless-steel

Gerber Group October 10, 2023

Are anti-circumvention actions now coming against EU stainless steel?

10 October 2023 – Will the anti-circumvention proceedings against stainless steel from Indonesia boomerang on EU mills? There are indications that this is the case. Nickel price in Asia rises by about 1.8%. And be careful where you ship stainless steel.

Nickel prices up in Asia

Nickel prices on the Asian SHFE have risen between 1.3% and about 1.8% today. Spot market prices for nickel have also risen by up to 2.0% in China. Prices for 304 stainless steel scrap have been holding steady since mid-August and have and have increased by just over 8% in the last 6 months.

Are anti-circumvention actions now coming against EU stainless steel?

The argumentation of the EU stainless steel producers in the current EU anti-circumvention proceedings against cold-rolled stainless steel from Turkey, Taiwan and Vietnam via Indonesia, as already in the anti-circumvention case against hot-rolled stainless steel from Turkey, is based on an alleged lack of or minimal added value from slab to hot-rolled to cold-rolled. The fact that this is a bold claim based on fragile figures is likely to lead to some further discussion.

Stainless steel slabs from Indonesia

But if we take a closer look at this point of the lack of added value and look at the official statistical data from EUROSTAT regarding the flow of stainless steel slabs originating in Indonesia for the years 2019, 2020, 2021 and 2022, we might ask the heretical question at what point some European producers of cold-rolled stainless steel would have to be told that their added value from slab to coil is too low? Because this would mean circumventing the existing anti-dumping and anti-subsidy measures against cold-rolled stainless steel from Indonesia.

EU27 Imports of Stainless Steel Slabs from Indonesia – 2018 to 2022

Source: EUROSTAT

After all, at least two names known in Europe or the world can be found here in the relevant databases. People! How mendacious can you actually be?

Stainless steel: Be careful from where you ship it

As you know us, we always warn you about dangerous offers. Currently, offers of stainless steel cold rolled from Taiwan to Europe are entering the market. These pretend to come from origins other than those currently affected by the anti-circumvention investigation.

Please bear in mind that in such a case the material is still shipped from Taiwan and thus subject to registration under the customs number established for the current proceeding. And thus could also be affected by possible measures.

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304 Stainless steel Carbon Footprint Comparision-EU, Indonesia and China

Technical Report · October 2022

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304 grade Stainless Steel Carbon Footprint Comparison EU, Indonesia and China (Final Report)

2022-10-17

Rutger Gyllenram

Wenjing Wei

Performed by KOBOLDE & PARTNERS AB

Commissioned by EUROFER THE EUROPEAN STEEL ASSOCIATION

Summary

The impact of scrap usage, alloy sources and electric grid mix for stainless steel has been calculated in this report comparing EU, Indonesia and China.

For this study, fundamental data on raw material quality, process parameters and inventory data for raw materials have been used to calculate the gate-to-gate carbon footprint, CF, for 1 ton 304 grade hot rolled black coil. In the scenario of EU, the calculated CF through modelling is verified by the EU (actual) which is the carbon footprint based on an average plant inventory in EU. The inventory data was collected from top four stainless steel producers in EU during 2019-2021. Market information about the use of different process lines in China is fetched from publications in Chinese, not always original sources. The rest data is fetched mainly from peer reviewed papers and private communication. For nickel production, published models programmed in EXCEL have been used with slight modifications to suit the purpose of this report. For steel production in EAF and AOD the optimisation tool RAWMATMIX® has been used. The energy consumption and metal yield during casting and hot rolling is assumed the same for all the scenarios. The average emission factor is used in this work to indicate the origin difference when using nickel alloys, FeCr and FeSi in steelmaking in EU, Indonesia and China. The alloy material supply routes in these three regions are based on the alloy production, import and export during 2020-2021.

The calculations indicate that the carbon footprint for 304 grade black coil (18% Cr, 8% Ni, 1.4%Mn, 0.03 %C) under assumed conditions is 5.6 times higher in Indonesia and 4.6 times higher in average China. The emission increment is 8.7 tCO_2-eq/t steel in Indonesia and 6.7 tCO_2-eq/t steel in China average.

In this study, a fixed alloy grade is assumed for FeNi (28%), HC FeCr (53%) and FeSi (76%) independent of the steelmaking site. Uncertainty of raw material carbon footprint may arise with the alloy grade used since a variety of alloy grades are normally used in operation in a region. Furthermore, the alloy inventory data to calculate the region-based emission factors is collected from publicly available data with uncertainties depending for example on the status of the process technology studied.

It should be noted, this study is not a full LCA study and it is the difference between the alternatives that are of importance. The calculation of the carbon footprint reflects the production of one specific grade 304 is based on metallurgical optimisation modelling. The gate-to-gate carbon footprint therefore does not include all yield losses which occur in a production plant during normal operations and producing a large variety of grades. It is therefore hard to compare this footprint with the footprint which is reported by companies under the European Emission Trading Scheme and which is based on emissions from actual annual production of all produced grades. The modelled carbon footprints are also not comparable to cradle-to-gate Environmental Product Declarations (EPDs) of stainless steel or other steel, which normally include impacts from additional processes, and are based on actual input and output data collected from production sites.

The data for EU is verified by comparing the modelled data with average data collected from four major steel producers. The data for Indonesia and China is collected from literature and private communication with project partners in good faith. Real data from plants in China and Indonesia may deviate from these values but it is the opinion of the authors that it is a good reflection of the average situation.

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1. Background and aim

Regulatory measures to create incentives to reduce carbon dioxide emissions within the EU have given rise to a need to compare the carbon footprint, CF, as defined in ISO standards[1] between identical products produced with different processes, different raw materials and under different conditions.

The purpose of this study is to give a picture of how differences in stainless scrap usage, origin of alloy raw materials and electricity grid mix affect the carbon footprint of austenitic stainless steel 304 grade under conditions prevailing in EU-27, Indonesia and China.

It should be noted that it is not a full LCA study and it is the difference between the alternatives that are of importance. The calculated carbon footprints are therefore not comparable to cradle-to-gate Environmental Product Declarations (EPDs) of stainless steel or other steel, which normally include impacts from additional processes, and are based on actual input and output data collected from production sites. The system boundary in the current work is gate to gate for 304 from scrap to black coil. The data for EU is verified by comparing the modelled data with average data collected from four major steel producers. The data for Indonesia and China is collected from literature and private communication with project partners in good faith. Real data from plants in China and Indonesia may deviate from these values but it is the opinion of the authors that it is a good reflection of the average situation.

The report is commissioned by Eurofer and has been prepared by Rutger Gyllenram and Wenjing Wei from Kobolde & Partners. Most valuable input has been given by Peter Samuelsson from M3 Advice, Camilla Kaplin from Outokumpu, Francis Diet from Aperam and Matteo Rigamonti, Hans Regtuit and Nicholas Avery from Eurofer. Athenea Lozano Jimenez from Acerinox and Emilio Santa Maria from Terni Arvedi have also supported the project.

[1] EN ISO 14067:2018, Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification (ISO 14067:2018)

In a parameter study by Gyllenram et al[2] four different charging cases and three different electricity sources are studied in a European context shown in figure 1. It is obvious that the ratio of alloyed scrap and the ferro alloys is much more relevant for the footprint than the electric grid mix.

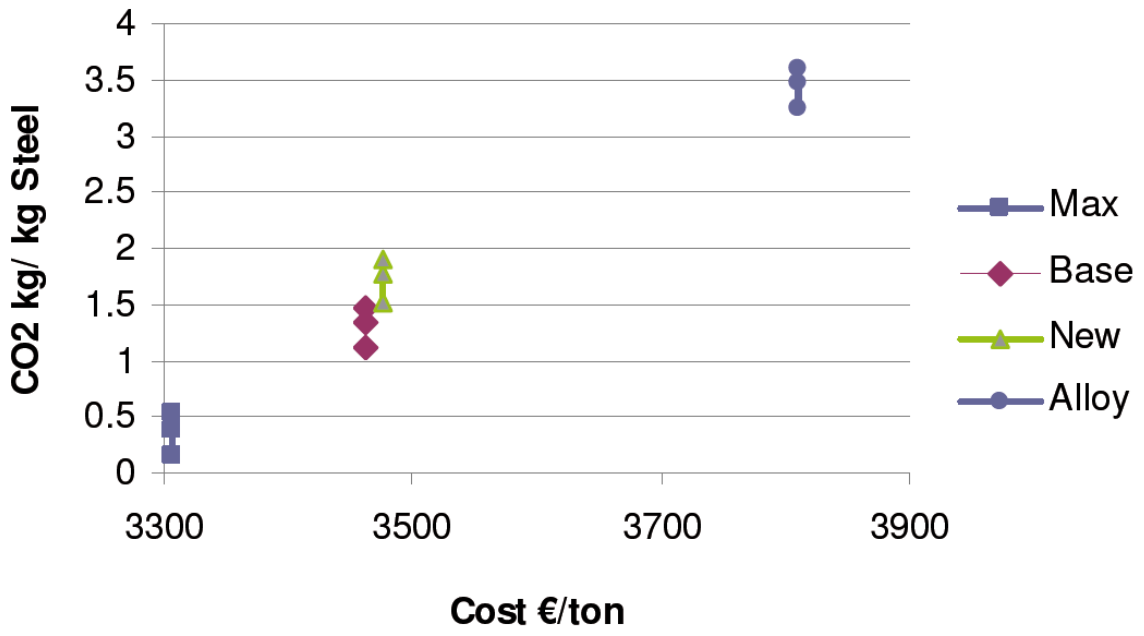


Figure 1 Carbon footprint, CF, scope 1-3, for stainless steel 18-8. Electricity CF ranges from wind power, via EU Electric grid mix to Coal combustion with 17, 539, 819 kg CO_2/MWh respectively. The Max case uses 100% stainless scrap and the Alloy case uses 100% merchant steel scrap and primary alloys. The Base and New cases use 20% merchant steel scrap and 20% metallics carrying a scope 3 CF, respectively. The CF for Ni- cathodes and Cr are derived from GaBi (2011) and are 10 and 8 kg CO_2/kg respectively.

Nickel is produced from either sulphide ores or oxidic laterite ores resulting in nickel cathodes, Ni cath, Nickel Oxide, NiO, Ferro Nickel, FeNi, or Nickel Pig Iron, NPI, with different values for the CF. The laterite ores contain iron, nickel and rather high amounts of crystal water that has to be removed before further processing which is an energy demanding operation.

NPI can be produced either in a combination of a Rotary Kiln and an Electric submerged arc Furnace, RKEF or in a Blast Furnace, BF. In the latter all the iron is reduced resulting in a pig iron with a nickel content around 3%. In the former process the reduction can be controlled and a richer product well above 10% can be obtained.

The energy use and CF for nickel production both depend on the nickel content in the ore. The energy use in ferro nickel production from laterite ores ranging from 2.5% to 0.5% is calculated by Wei et al[3] and is shown in figure 2. Depending on process layout and grid mix, production of NPI in RKEF as well as the resulting CF would show a similar pattern.

[2] Gyllenram R., Jönsson P. G., Ekerot S. Persson F., Ternstedt P., Taking in house and up stream CO_2 emission into account in charge optimization for scrap based steel making, Metec InSteelCon Düsseldorf, 27 June-1 July 2011

[3] Wei W.; Samuelsson, P.B.; Tilliander, A.; Gyllenram, R.; Jönsson, P.G. Energy Consumption and Greenhouse Gas Emissions of Nickel Products. Energies 2020, 13, 5664. weblink

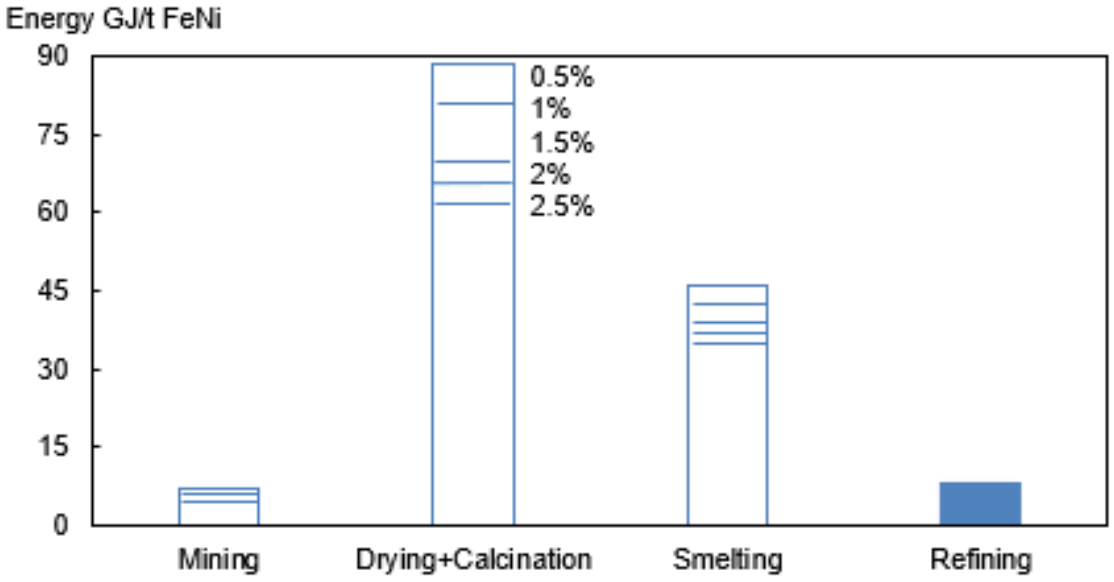


Figure 2 Energy use for production of ferronickel (35% Ni) showing the levels for nickel content in the laterite nickel ore of 0.5% - 2.5%.

Nickel alloy is mostly consumed in 300 series stainless steelmaking, which is also the most produced stainless steel. As shown in table 1, the production of 300 series steel accounts for 71%, 50% and 100% of the total stainless steel production in EU, China and Indonesia, respectively. Among 300 series stainless steel the 304 grade, containing a high nickel and chromium content (Ni: 8-10.5%; Cr:18-20), is regarded as the most common austenitic stainless steel. It has excellent corrosion resistance properties and is widely used in kitchen alliances, food handling and processing, heat exchangers etc.

Stainless steel is generally produced by melting scrap and alloys in an Electric Arc Furnace, EAF, followed by further alloying, decarburisation and refining in either an Argon Oxygen Decarburisation converter, AOD, or a Vacuum Oxygen Decarburisation unit, VOD. Depending on product portfolio and local conditions the choice of process and raw materials may differ as well as when and where alloys are added. Steel production located close to the production of ferro alloys may give the opportunity to charge the alloys in liquid form. RKEF NPI may be charged directly in an AOD.

In EU, FeNi is the main nickel alloy consumed in stainless steelmaking, a small ratio of Ni cathode is used for analysis adjustment. In terms of China and Indonesia, the main nickel source is RKEF-NPI (10-15%Ni) which is considered as a both economic and easily accessible nickel product in the market. In China, low grade BF-NPI (1.6-4% Ni) is also used nowadays, representing less than 15% of total NPI production in China. More information of the nickel use in China and Indonesia can be found in appendix A.

Table 1 Crude Stainless Steel (SS) Production in EU, China and Indonesia in 2021 [1-2]

	EU	China	Indonesia
Reference year	2021	2021	2021
World's SS production Ratio	12%	58%	9%
Total Production (kt)	6 953	32 450	4 942
Production Ratio	Sweden/Finland/Slovenia/Czech Rep/Poland:32% Austria Belgium: 23% Italy: 22% Spain: 13% Germany: 6% France: 4%	Fujian 25% Guangxi 18% Guangdong: 13% Shanxi: 10% Shandong: % Zhejiang: 4% Gansu: 3% Inner Mongolia: 3% Henan; 3% Liaoning: 2% Sichuan: 2% Yunnan: 2%	TSI (Tsingshan): 71% VDNI (De Long): 29%
Steel grades	300 series: 71.3% [3] 304 grade: 51.6% [3] (The value is a combination of Europe and Africa in 2020)	200 series: 30% 300 series: 50% 400 series: 19%	300 series: 100%
[1] EUROFER, Crude Stainless Steel Production in EU (EXCEL) in 2021, accessed on 2022-06-24 [2] Mysteel: Stainlesss Steel production in 2021 and the analysis for increased production in 2022 (in Chinese). Available online: weblink (accessed on 2022-06-22) [3] ISSF, Stainless steel melt shop production by grade category and region in 2020 (accessed on 2022-06-24 through EUROFER)			

2. Method and restrictions

2.1 General

Fundamental data on raw material quality, process parameters and inventory data for raw materials have been used to calculate the carbon footprint of the stainless steel product.

Production of alloys used in stainless steelmaking, such as nickel, FeCr and FeSi are energy intensive and may have big differences in carbon footprint depending on the production site. In the current work, region-based carbon footprint values of nickel alloys, HC FeCr and FeSi are calculated and documented in appendix A-C. The carbon footprint values are calculated as weight average values depending on the material origins referring to statistics on production, import and export in EU, China and Indonesia during 2020-2021.

For nickel production published process models programmed in EXCEL have been used with slight modifications to suit the purpose of the report (appendix A). The inventory data of FeCr (appendix B) and FeSi (appendix C) is collected from publicly available data. Published data have uncertainties depending on the status of the processes studied. In addition, the uncertainty of material's carbon footprint may arise with the alloy grade. For instance, it exists quality variation in real operation when using FeNi (16-42%Ni), HC FeCr (50-70%C), FeSi (58-76%), indicated in table 2. In this study, a fixed alloy grade is assumed for FeNi (28%), HC FeCr (53%) and FeSi (76%) independent of the steelmaking site.

The optimisation tool RAWMATMIX® has been used for the stainless steel production in the EAF-AOD route and the AOD with input of liquid NPI. The same energy loss functions in the EAF and AOD have been assumed regardless of raw materials and production site to ensure that only scrap ratio, raw material analysis and electricity grid mix affect the calculated carbon footprint. The use of the tool ensures that calculations are consistent from a metallurgical point of view.

2.2 Stainless Steelmaking

The thermodynamic calculations for stainless steelmaking are made for **100 tonnes charges of liquid 304 grade steel, ready to cast, with 18% Cr, 8% Ni and 1.4% Mn, 0.03% C,** the balance being Fe. No transport is considered for raw materials from production site to the steel plant. No dust generation or metal droplet loss to slag in EAF/AOD.

Other consumables such as fuel/electricity used in auxiliary devices in melt shop (casting, pump, ventilation etc., ladle heating etc.) and hot rolling are also included in this study, to further assess the carbon footprint of commercial trade goods of **304 grade hot rolled black coil**.

2.2.1 Inventory and case study

In this study, interviews and questionnaires have been performed to obtain the inventory data of 304 grade steelmaking. Four European stainless steel producers participated in the data collection procedure, representing 72% of the total stainless steel production (6953 kt) in EU in 2021. The collected EU inventory data is based on an annual production of 304 grade steel production. The reference year is 2019 (one producer) and 2021 (three producers).

The authors in this report ensure the confidentiality of all collected data for each participated producer. A weight averaged inventory data is calculated and presented in table 2.

Table 2 Inventory for producing one tonne 304 grade hot rolled black coil in EU

	Inventory	Unit	Amount	Comment
Melt shop	Stainless Steel Scrap	kg	866	
	Carbon Steel Scrap	kg	64	
	FeNi	kg	50	16-42% Ni
	Ni	kg	7	
	FeCr	kg	92	50-70% Cr
	FeSiMn	kg	12	60% Mn, 27-30%Si
	FeSi	kg	25	58-76%Si
	Al	kg	2	
	Coal	kg	2	
	Coke	kg	2	
	Electrode	kg	2	
	Lime (EAF+AOD)	kg	89	
	Dolomite (EAF+AOD)	kg	31	
	Brick material	kg	23	
	O_2 (EAF+AOD)	Nm^3	39	
	Ar	Nm^3	17	
	N_2	Nm^3	27	
	Electricity	kWh	450	EAF
	Electricity	kWh	64	Auxiliary in melt shop e.g., CCS, slab grinding, fan etc.
	Natural gas	KWh	25	EAF
	Natural gas	kWh	123	Auxiliary in melt shop e.g., ladle preheating
Hot Rolling	Electricity	kWh	99	
	Natural gas	kWh	516	
	Yield	%	99	

In the **EU scenario**, the scrap ratio and other material consumption data refer to a weight average inventory in EU-27, displayed in table 2.

Limited information of raw material mix can be accessed through public domain for the scenarios of China and Indonesia. The inventory for China and Indonesia when producing 304 grade steel is based on a combination of public data and private communication with project partners.

In the China scenario, four raw material mixing strategies are widely used in producing 300 series steel in China as given in Table 3. *Ordinary* mixing accounts for 30-40% of the production, for instance, Bao Steel, Tai Steel. *High grade NPI* mixing is used in about 30% stainless steel production, included in a new developed process, RKEF+AOD where the liquid NPI is directly used in AOD to utilize its physical heat and save energy consumption. The representatives are Tsingshan and Delong. Both *Ordinary* and *High grade NPI* mixing require a nickel content of 10-12% in NPI, or even higher. *Low grade NPI* and *Ni* mixing strategies using pure nickel are less economic and produced in a very small ratio.

In this work, three cases are studied in **China scenario**, including ***ordinary (China a)*, high grade NPI (China b)** and ***Ni (China c)*** mixing. *Low grade NPI* produced in blast furnaces is regarded as the main nickel sources for the 200 series steel which has low demand of nickel content and is excluded in the study. In addition, a case based on weight average is estimated for the China scenario, assumed as 80% China a+15% China b + 5% Ni China c.

Table 3 Four common raw material mixing strategies in Chinese 300 series steelmaking [4]

Mixing Strategy	Ordinary	High grade NPI	Low grade NPI	Ni
Nickel pig iron	48%	71%	63%	-
Pig iron/common steel scrap	7%	2%	-	-
FeCr	21%	26%	26%	27%
Ni	1%	-	6%	7%
Stainless steel scrap	21%	-	3%	64%
Other alloys	2%	2%	2%	2%
This work	**China a**	**China b**	**-**	**China c**
Assumed production volume	**80%**	**15%**	**-**	**5%**

Considering the current situation of stainless steel scrap shortage and plant location in Indonesia, the **Indonesia scenario** is assumed to be similar to the *High grade NPI* mixing in table 3 with low demand of stainless steel scrap. This alternative uses RKEF+AOD route (Tsingshan and Delong), which charges NPI in liquid form. Assume 2% stainless steel scrap is used instead of pig iron/common steel scrap stated in table 3.

In summary, following cases with designed raw material mixes are used as a calculation basis in Europe, Indonesia and China for a **100-tonne 304 grade stainless steel charge,** shown in Table 4. The amounts may be different in the final calculations related with a consistent heat and mass balance in the modelling work.

Table 4 Case studies in producing 304 grade stainless steel in the scenarios of EU, China and Indonesia

Case	SS route	Inventory	SS scrap ratio	Ni source	Comments
EU (actual)	EAF+AOD	Plant data	79%	FeNi +Ni	-
EU	EAF+AOD	Modelling	79%	FeNi +Ni	All alloys added in EAF
Indonesia	AOD	Modelling	2%	NPI (liquid)	Solid NPI used as coolants.
China a	EAF+AOD	Modelling	21%	NPI +Ni	All alloys added in EAF
China b	AOD	Modelling	0 %	NPI (liquid)	Solid NPI used as coolants.
China c	EAF+AOD	Modelling	64 %	Ni	All alloys added in EAF
China (average)	80% China a+15% China b + 5% Ni China c				

2.2.2 Process calculations in the EAF-AOD route

The EAF-AOD route as modelled in this study is shown in figure 3. The EAF is charged with Stainless steel scrap (16.3%Cr, 7.75%Ni), low alloy scrap, nickel raw materials, ferrochromium and slag formers. Oxygen is injected in the EAF to decarburise to 0.75%C and allow for around 300 kg inject carbon. Natural gas in oxyfuel burners gives additional 2500 kWh per heat. 1000 kg of dolomite and 2900 kg of lime together with 700 kg of magnesite bricks are added. At the end of the charge, 500 kg of ferrosilicon is added to reduce the iron, chromium and manganese in the slag back to the melt. The yield for these elements after the reduction is assumed to be 99%, 97% and 95%.

[4] Cinda Futures, Special report: Details of Nickel demand-Stainless steel supply (in Chinese) (2021) Accessed on 2022-01-24, weblink

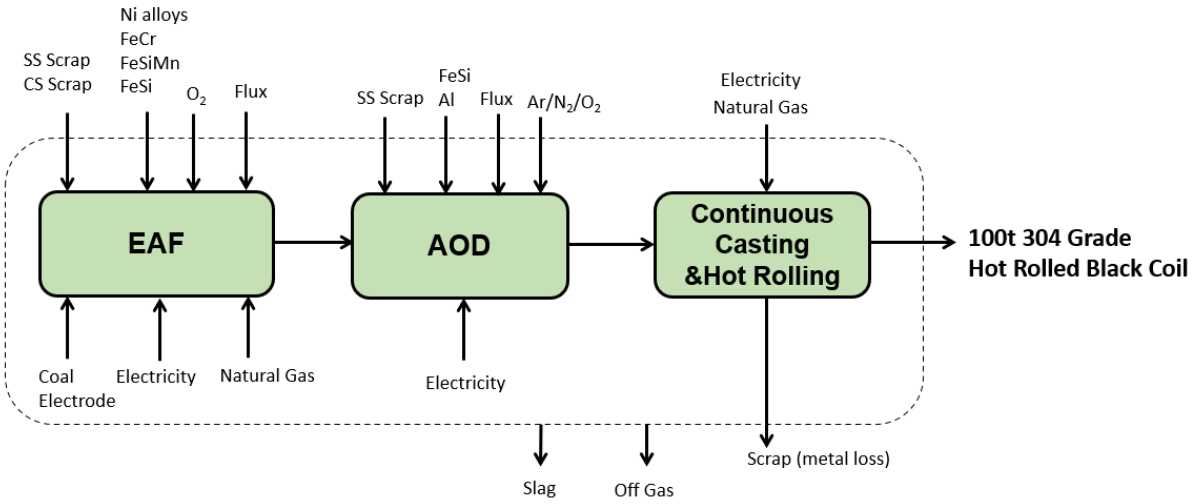


Figure 3 The EAF-AOD process route. All alloys are added to the EAF which is a simplification.

The AOD is used for decarburisation down to 0.03% C using oxygen and 4400 Nm^3 of inert gases (Ar+N2). For each charge 10 ton of stainless steel cooling scrap (16.3%Cr, 7.75%Ni) is added together with 2100 kg dolomite, 6000 kg lime and 1600 kg magnesite bricks/lining. The AOD process ends with reduction of the metal oxides with 2000 kg of ferrosilicon and 200 kg aluminium. The yield for iron, chromium and manganese after the reduction is assumed to be 99%, 97% and 95%.

Auxiliary electricity (casting, pump, ventilation etc), electricity used in hot rolling, auxiliary gas fuel (ladle preheating) and gas fuel in hot rolling is assumed for one charge (100 tonne) as 6400 kWh, 9900 kWh, 12300 kWh and 51600 kWh, respectively. These consumptions are referring to an average inventory in EU (see table 2).

2.2.2 Process calculations in the RKEF-AOD route

The RKEF-AOD route as modelled in this study is shown in figure 4. For two cases, *Indonesia* and *China b*, NPI of 1350°C [5] is charged to the AOD. RKEF NPI with carbon content of 2%. Some solid NPI is also charge as coolant.

All the alloys and scraps, together with 2100 kg dolomite, 6000 kg lime and 1600 kg magnesite bricks are charged together in AOD. The AOD is used for decarburisation down to 0.03% C using oxygen and 4400 Nm^3 of inert gases (Ar+N2). The AOD process ends with reduction of the metal oxides with 2000 kg of ferrosilicon and 200 kg aluminium. The yield for iron, chromium and manganese after the reduction is assumed to be 99%, 97% and 95%.

Auxiliary electricity (casting, pump, ventilation etc), electricity used in hot rolling, auxiliary gas fuel (ladle preheating) and gas fuel in hot rolling is assumed for one charge (100 tonne) as 6400 kWh, 9900 kWh, 12300 kWh and 51600 kWh, respectively. These consumptions are referring to an average inventory in EU (see table 2).

[5] Chen W., Characteristics of the stainless steel production using molten nickel iron as main raw materials (in Chinese) (2018), industrial heating, volume 47, issue 1, pp.63-65

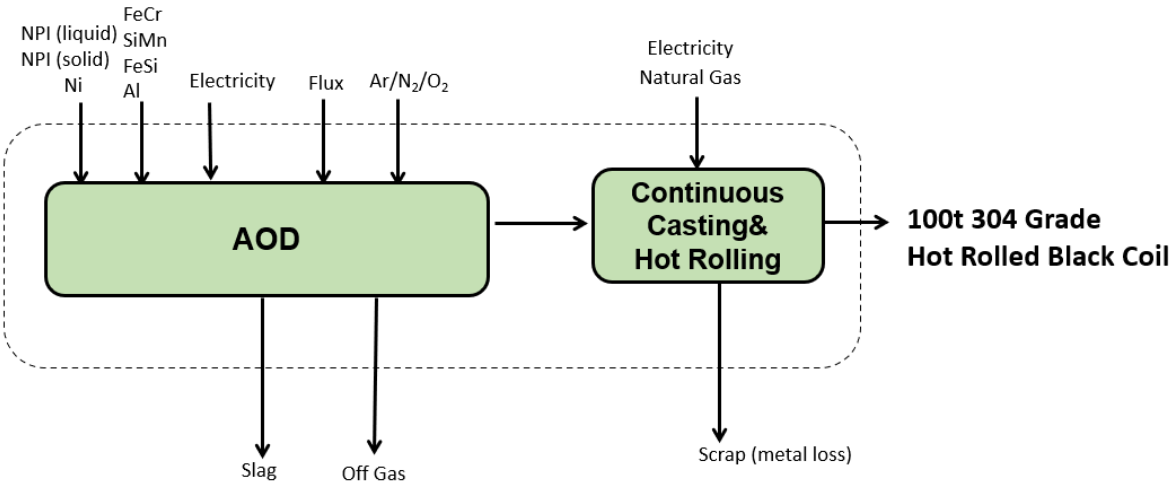


Figure 4. The RKEF-AOD route. Hot nickel pig iron together with other alloys are charged directly in AOD

3. Input data

3.1 Raw material analysis

The raw materials used in the EAF and AOD are assumed to have the simplified analysis provided in table 5 for metallic materials and oxidic materials.

3.2 Carbon footprint data

Carbon footprint of stainless steelmaking consists of three typical parts, namely scope 1 (direct/process emission), scope 2 (electricity, indirect/upstream emission) and scope 3 (indirect/upstream emission). Some steel plants are integrated with production of alloy materials and captive power plant, for instance NPI (Tsingshan Indonesia), FeCr (Tornio), which can sometimes have different scope categories. However, these integrated steel plants are exceptions. In the current work, for easy comparison reason, scope 1, scope 2 and scope 3 in 304 grade steelmaking are defined as follows for all the studied cases:

- **Scope 1:** direct emissions consist of the CO_2 generated by decarburisation of the steel, the burners using natural gas, consumption of the electrodes and the coal injection. It is assumed that all carbon is fossil and no CO_2 is sequestrated. Emission factors related to scope 1 can be found in table 6c.
- **Scope 2:** indirect emissions consist of the burdens from electricity used in the electric arc furnace. Emission factors related to scope 2 is shown in table 6c.
- **Scope 3**: indirect emissions for manufacturing raw materials are listed in table 6a and table 6b. It is based primarily on literature or calculated data rather than EPD-data.

Table 5 Metallic raw materials used in the calculations

Metallic Materials													
	Fe	**C**	**Mn**	**Cr**	**Ni**	**Al**	**Co**	**Si**	**SiO_2**	**Al_2O_3**	**CaO**	**MgO**	**Balance**
SS Scrap	74.52	0.03	1.4	16.3	7.75								
CS scrap	98.87	0.05	0.8	0.1	0.08			0.02					0.08
FeNi (EU aver.)	71.27	0.02			28.25		0.46						
NPI (Indonesia average)	82.41	2		2.44	12.75			0.4					
NPI (China average)	83.19	2		2.27	12.14			0.4					
Ni					100								
FeSiMn	15.5	1.5	66					17					
FeCr	38.5	7		53				1.5					
FeSi	22.35	0.1	0.05			1.5		76					
Al						100							
Burnt lime											100		
Burnt dolomite											70	30	
Lining												100	
Coal		93.76							4.19	1.42	0.44	0.19	
Coke		90.192	0.01						6.469	3.329			
Electrode		100											

Table 6a CF data (Scope 3) for alloys and reductants used in this study

Input Source	Emission Factor (kg CO_2-eq/unit)		Comment
	1 kg alloy	1 kg alloy metal	
Ni (100%Ni)	11.7	11.7	Sulfide ore, Flash furnace, Australia based, electricity is country average (0.703kgCO_2-eq/kWh) [1]
FeNi (EU average,28.29%Ni)	17.2	60.9	RKEF, Electricity emission factor (0.329kgCO_2/kWh) is assumed as 45% Brazil+19% New caledonia+18% Greece+18% UK, representing FeNi origins in EU [1]
NPI (Indonesia average,12.75%Ni)	11.2	87.5	RKEF, produced in Indonesia, coal-based electricity (1kgCO_2/kWh) [1]
NPI (China average,12.14%Ni)	10.6	87.2	Emission factor and alloy grade are weight average of 60% NPI- Indonesia average+40%NPI-China. NPI-China (10.2%Ni) is produced in China with imported Philippine ores through RKEF process. Electricity emission (0.866kgCO_2/kWh) is weight average from NPI production regions, representing 67% of NPI production in China. [1]
HC FeCr (EU average, 53%Cr)	2.83	5.35	Assume 48% Finland+ 37% South Africa+ 15% Sweden [2]
HC FeCr (China average,53%Cr)	5.7	10.76	Assume 75% China+17% South Africa+ 8% Kazakhstan [2]
HC FeCr (Indonesia average, 53%Cr)	4.97	9.38	Assume 64% South Africa+23% Indonesia+ 13% Kazakhstan [2]
FeSi (EU average, 76%Si)	4.65	6.12	54%Nowrway+25% Spain+21% Poland, the weight average is described as grid mix emission factor. [3]
FeSi (China average, 76%Si)	10.84	14.27	Produced in China, electricity emission factor is using the grid mix in North China Region (0.942 kgCO_2/kWh) [3]
FeSi (Indonesia average, 76%Si)	10.84	14.27	Imported from China [3]
SiMn (66%Mn,17%Si assumed)	6.94		IMnI LCA (65-68%Mn, <2%C), reference year 2010, representing 26% of global Mn extraction and 8% global Mn alloy production [4]
Al (primary)	17	17	IAI Global, 2015 inventory data [5]

*Emission factor for 1 kg alloy metal is only for comparative purpose. Emission factor for 1kg alloy is used in CF calculation.
[1] Simulation based emission factor, more described in Appendix A.
[2] Estimated emission factor based on public inventory data, see Appendix B.
[3] Estimated emission factor based on public inventory data, see Appendix C
[4] Westfall, L.A., et al. Cradle-to-gate life cycle assessment of global manganese alloy production. Int J Life Cycle Assess 21, 2016
[5] IAI, Adddendum to the life cycle inventory data and environmental metrics for the primary aluminium industry, 2018

Table 6b CF data (Scope 3) for scrap, slag formers and gases used in the EAF-AOD process line

Input Source	Emission factor		Comment
Scrap (SS/CS)	0.007	$kgCO_2$-eq/kg	The emission comes after the waste management, e.g., scrap transport, scrap upgrading etc. RAWMATMIX data [8]
Lime	0.95	$kgCO_2$-eq/kg	World Steel Association [7]
Dolomite	1.1	$kgCO_2$-eq/kg	World Steel Association [7]
Lining	0.0636	$kgCO_2$-eq/kg	LCA study [9]
Oxygen	0.073-0.5	$kgCO_2$-eq/Nm^3	0.5kWh/Nm^3 [10]
Nitrogen *	0.073-0.5	$kgCO_2$-eq/Nm^3	0.5kWh/Nm^3[10]
Argon *	0.145-1	$kgCO_2$-eq/Nm^4	1 kWh/Nm^3[10]

* In this study, a gas mixture of 1700Nm^3 Ar+2700Nm^3 N2 is assumed for AOD process in all cases.
[8] Arzpeyma, Niloofar & Gyllenram, Rutger. (2021). RAWMATMIX Standard materials and energy sources 20210110. 10.13140/RG.2.2.32940.69760.
[9] Boenzi, Francesco & Ordieres-Meré, Joaquín & Iavagnilio, Raffaello. (2019). Life Cycle Assessment Comparison of Two Refractory Brick Product Systems for Ladle Lining in Secondary Steelmaking. Sustainability. 11. 1295. 10.3390/su11051295.
[10] Private communication, Joachim von Schéele, Linde Gas, electricity consumption for process gas (2022)

Table 6c CF data (scope 1 and scope 2) for energy used in this study

Input Source	Emission Factor ($kgCO_2$-eq/unit)			Comment
	upstream	Process	Unit	
Electricity (EU average, SS)	0.145	-	kWh	Electricity used in stainless steelmaking process. Weight average of European Stainless steel production countries (table 1). EEA (2020) [4]
Electricity (China average, SS)	0.835	-	kWh	Electricity used in stainless steelmaking process. Weight average of Chinese Stainless steel production regions in 2021 (table 1), National Average Emission Factor for Electricity in China (2019) [5]
Electricity (Indonesia average, SS)	1	-	kWh	Electricity used in stainless steelmaking process is coal based (table 1). [6]
Natural Gas	0.067	0.202	kWh	35.9 MJ/Nm^3 [7]
Pulverised coal	0.79	3.66	kg	93.76%C
Coke	0.224	3.257	kg	90.19%C
Electrode	0.65	3.665	kg	[7] 100%C

[4] European Environment Agency, Greenhouse Gas Emission Intensity of Electricity Generation by Country (2021), weblink (Accessed on 2022-02-07)
[5] Ministry of Ecology and Environment of the People's Republic of China, Greenhouse gas emissions accounting methods and Reporting Guidelines for Power Generation Facilities, 2019, weblink (accessed 2022-06-14)
[6] UK Parliament. Carbon Footprint of Electricity Generation (Postnote). 2006. Available online: weblink (accessed on 13 September 2020)
[7] Worldsteel Association, CO_2 data collection-User Guide, version 10 (2021)

4. Results

The calculation results for liquid steel ready to cast is under ideal conditions. Other than losses to slag, a metal loss 1% is assumed during hot rolling. Results of studied cases are presented in table 7, figure 5 and figure 6.

Table 7 Actual and modelled Inventory and carbon footprint of 1 t 304 black coil for the studied cases.

		EU actual	EU	Indonesia	China a	China b	China c	China(Ave)[1]
Inventory Source		Plant data	Model	Model	Model	Model	Model	Average
Inventory								
SS Scrap	kg	865	830	20	228	0	353	200
CS Scrap	kg	65	30	0	10	20	321	27
FeNi	kg	50	50	0	0	0	0	0
NPI	kg	0	0	703	520	694	0	520
Ni	kg	7	8	0	12	0	70	13
FeCr	kg	92	95	312	258	320	280	268
SiMn	kg	11	4	22	17	22	11	18
FeSi (EAF+AOD)	kg	25	25	20	25	20	25	24
Al	kg	2	2	2	2	2	2	2
Coal	kg	2	3	0	3	0	2.99	3
Coke	kg	2	0	0	0	0	0	0
Electrodes	kg	2	2.3	0	1.6	0	1.8	1
Lime (EAF+AOD)	kg	89	89	60	89	60	89	85
Dolomite (EAF+AOD)	kg	31	31	21	31	21	31	30
Refractory (EAF+AOD)	kg	23	23	16	23	16	23	22
Oxygen (EAF+AOD)	Nm^3	39	25	63	52	63	41	53
$Ar+N_2$	Nm^3	44	44	44	44	44	44	44
Electricity (EAF)	kWh	450	454	0	316	0	367	271
Electricity (Auxiliary)	kWh	64	64	64	64	64	64	64
Natural gas (EAF)	kWh	25	25	0	25	0	25	21
Natural gas (Auxiliary)	kWh	123	123	123	123	123	123	123
Electricity (hot rolling)	kWh	99	99	99	99	99	99	99
Natural gas (hot rolling)	kWh	516	516	516	516	516	516	516
CF scope 1 (kg CO_2-eq)								
Natural gas		134	134	129	134	129	134	133
Coal		7	11	0	11	0	11	9
Coke		7	0	0	0	0	0	0
Electrode		7	8	0	6	0	7	5
Decarburization		0	25	132	104	133	72	107
CF scope 2 (kg CO_2-eq)								
Electricity (melt shop)		75	75	64	317	53	360	280
Electricity (hot rolling)		14	14	99	83	83	83	83
CF scope 3 (kg CO_2-eq)								
SS Scrap		6	6	0	2	0	2	1
CS Scrap		0	0	0	0	0	2	0
FeNi		860	860	0	0	0	0	0
NPI		0	0	7869	5512	7360	0	5514
Ni		82	94	0	140	0	819	153
FeCr		260	269	1549	1468	1826	1596	1528
SiMn		76	30	152	120	153	76	123
FeSi (EAF+AOD)		116	116	217	271	217	271	263
Al		34	34	34	34	34	34	34
Coal		2	2	0	2	0	2	2
Coke		0	0	0	0	0	0	0
Electrodes		1	1	0	1	0	1	1
Slag former (EAF+AOD)		120	120	81	120	81	120	114
Oxygen (EAF+AOD)		3	2	31	22	26	17	22
$Ar+N_2$		4	4	30	25	25	25	25
Natural gas (melt shop)		10	10	8	10	8	10	10
Natural gas (hot rolling)		34	34	34	34	34	34	34
Total CF (kg CO_2-eq) [2]								
Scope 1		155	180	263	258	265	226	257
Scope 2		89	90	165	404	137	447	366
Scope 3		1610	1599	10108	7841	9865	3042	7905
Total Carbon footprint		1855	1870	10536	8503	10267	3715	8528
CF/CF_{EU}			1	5.6	4.5	5.5	2.0	4.6
$\Delta=CF-CF_{EU}$			0	8666	6634	8398	1845	6659

[1] China(Ave) is weight average of 80% China a+ 15% China b+ 5% China c

[2] Modelling based CF is taking 1% metal loss during hot rolling

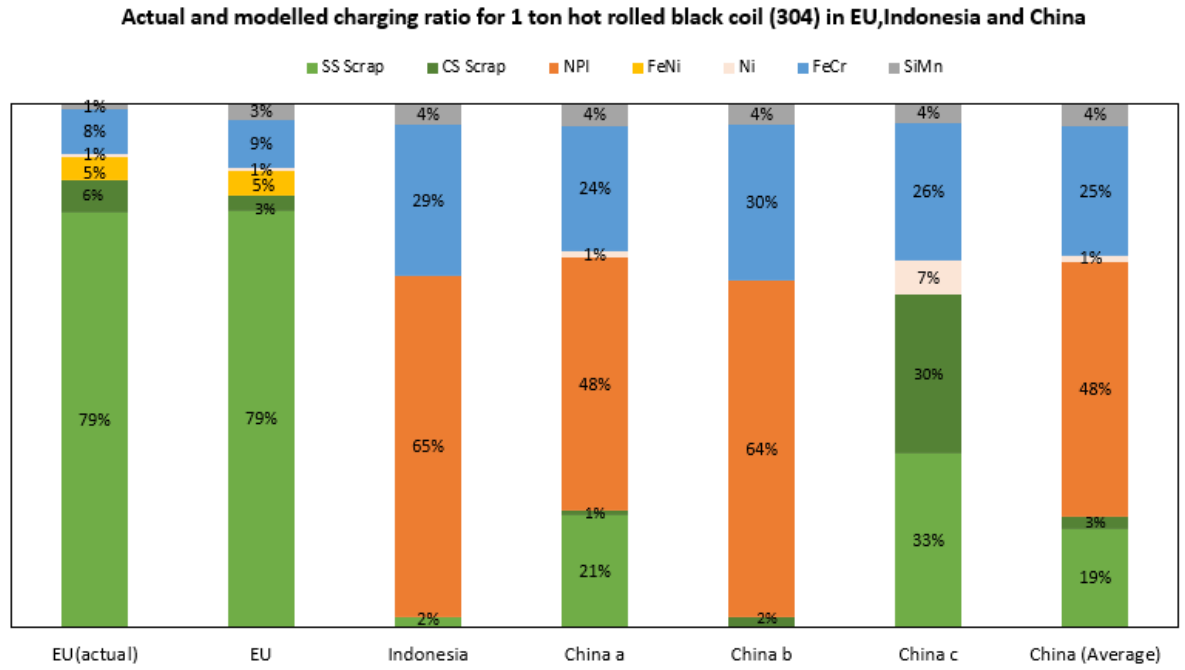
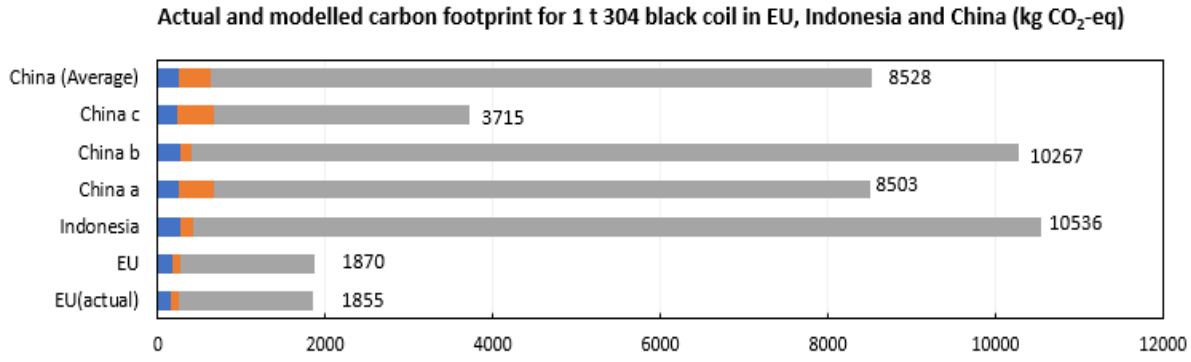


Figure 5 Actual and modelled charging ratio of 1 ton 304 grade black coil in EU, Indonesia and China (EU actual is based on average plant data and the rest is modelled charging ratio. Indonesia, and China b is charging hot liquid NPI in AOD directly with some solid NPI for coolant. China(Average) is 80% China a+ 15% China b+ 5% China c)



	EU(actual)	EU	Indonesia	China a	China b	China c	China (Average)
	Plant data	Model	Model	Model	Model	Model	80%China a+15%China b+5%China c
Scope 1	155	180	263	258	265	226	257
Scope 2	89	90	165	404	137	447	366
Scope 3	1610	1599	10108	7841	9865	3042	7905

Figure 6 Actual and modelled carbon footprint for 1 t 304 grade black coil in EU, Indonesia and China (Indonesia, and China b is charging hot liquid NPI in AOD directly with some solid NPI for coolant)

The material charging from actual plant data (table 2), literature (table 3) and modelling (figure 5) for EU, Indonesia and China are compared and presented in table 8.

The calculated and reference raw material mixes agree quite well in the cases of EU and China a. For Cases of Indonesia and China b, the AOD route using liquid NPI is applied in steelmaking. This route is commonly used in Tsingshan and Delong. Compared to the charging ratio of NPI in reference (Indonesia/ China b: 71%), the low NPI charging in calculation (Indonesia: 65%; China b: 64%) is offset by a higher FeCr demand. This is probably due to a low-grade FeCr (53% Cr) is used in the modelling.

As indicated in table 6a, China and Indonesia both import FeCr from Kazakhstan which is known as high-grade alloys and typically contains 60-70%Cr. In addition, 2% low alloy scrap is replaced by 2% stainless steel scrap in Indonesia case as the current steel production in Indonesia is mainly stainless steel based. In case China c, it is difficult to charge a high stainless steel scrap ratio as stated 64% in reference. Instead, a total scrap ratio of 33% SS and 30% is preferred in the model calculation. An explanation could be that 64% stainless steel scrap in reference may consist of low nickel scrap like 200 series and 400 series, representing 49% of the total stainless steel production in China (table 1).

As shown in Figure 6 and table 7, the calculated carbon footprint of 1 ton 304 hot rolled black coil is 1.87 tCO_2-eq, 10.54 tCO_2-eq and 8.53 tCO_2-eq for the scenarios of EU, Indonesia and China, respectively. The carbon footprint of producing 304 black coil is 5.6 times higher in Indonesia and 4.6 times higher in average China. The breakdown of scopr 3 emissions is shown in Appendix D.The emission increment of producing 1 ton 304 black coil is 8.7 tCO_2-eq in Indonesia and 6.7 tCO_2-eq in China average, suggested in Figure 7.

Table 8 Raw material mixing from actual plant data (actual), literature (lit.) and modelling (model) in EU, Indonesia and China

	EU		Indonesia		China a		China b		China c	
	actual	model	lit.	model	lit.	model	lit.	model	lit.	model
SS scrap	79%	79%	**0%**	**2%**	21%	21%	0%	0%	64%	33%
Pig iron/CS scrap	6%	3%	**2%**	**0%**	7%	1%	2%	2%	0%	30%
NPI	0	1	**71%**	**65%**	48%	48%	**71%**	**64%**	0%	0%
FeNi	5%	5%	0%	0%	0%	0%	0%	0%	0%	0%
Ni	1%	1%	-	0%	1%	1%	-	0%	7%	7%
FeCr	8%	9%	**26%**	**29%**	21%	24%	**26%**	**30%**	27%	26%
Other alloys	1%	3%	2%	4%	2%	4%	2%	4%	2%	4%

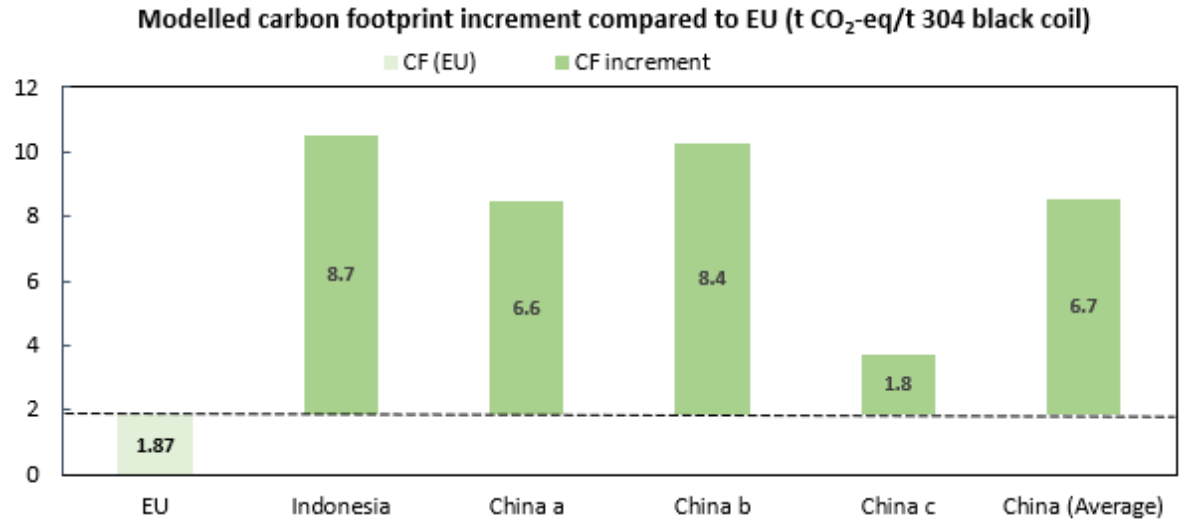


Figure 7 Modelled Carbon footprint increment for 1 t 304 black coil in Indonesia and China compared to EU

5. Discussion and conclusion

In order to evaluate how differences in stainless scrap usage, raw materials (nickel, FeCr, FeSi) and electricity grid mix affect the carbon footprint of austenitic stainless steel 304 under conditions prevailing in EU, Indonesia and China, five cases have been described. Inventory data for raw materials and thermodynamic process models have been used to calculate the carbon footprint for one tonne of 304 grade black coil product.

The calculations show that taking only differences in scrap usage, nickel/FeCr/FeSi sourcing and electricity grid mix into account, the carbon footprint of producing 304 black coil is 5.6 times higher in Indonesia and 4.6 times higher in average China. The emission increment is 8.7 tCO_2-eq/t steel in Indonesia and 6.7 tCO_2-eq/t steel in China average.

In general, such an evaluation must be based on verifiable data and must assume equal conditions when otherwise cannot be proved. Furthermore, the use of a process model ensures that material and energy balances in the five cases are consistent and can accommodate variations in practices.

It is worth noting:

- The data for EU is verified by comparing the modelled data with average data collected from four major steel producers. The data for Indonesia and China is collected from literature and private communication with project partners in good faith. Real data from plants in China and Indonesia may deviate from these values but it is the opinion of the authors that it is a good reflection of the average situation.
- The uncertainty of raw material's carbon footprint may arise with the alloy grade. In this study, a fixed alloy grade is assumed for FeNi (28%), HC FeCr (53%) and FeSi (76%) independent of the steelmaking site. It may exist difference in alloy grade compared to the used alloy materials in operation, which is also affecting the upstream emissions (Scope 3).
- The calculation of the footprint reflects the production of one specific grade 304 black coil based on metallurgical optimisation modelling. The gate-to-gate footprint therefore does not include all yield losses which occur in a steel production plant during normal operations and producing a large variety of grades. It is therefore hard to compare this footprint with the footprint which is reported by companies under the European Emission Trading Scheme and which is based on emissions from actual annual production. This however, is the same for both the European and the Asian operations.

- The study is not a full LCA study and it is the difference between the alternatives that are of importance. The calculated carbon footprints are not comparable to cradle-to-gate Environmental Product Declarations (EPDs) of stainless steel or other steel, which normally include impacts from additional processes, and are based on actual input and output data collected from production sites.

The authors suggest further studies to assess the uncertainties and to include other stainless steel grades.

Appendix A Carbon footprint of region-based nickel alloys

Background

Nickel is extracted from two types of deposits, namely laterite and sulfide ores. Sulfidic ore contains 1–3% Ni, can be processed either in a submerged electric arc furnace or a flash furnace into matte (15–40% Ni, and 20–40% Fe and 20–25% S), then further refined through hydrometallurgy into pure nickel. Laterite ore has a typical nickel content of 1-2.7% and a rather high moisture ratio 17-34%. The laterite ore can be further divided into two main groups, saprolite and limonite. Limonite is low grade laterite nickel ore (1.3%) and rich in iron content (>35%) while saprolite has a relatively high nickel content (2%) and rich in MgO (20%).[1] Due to high ratio of magnesia and

silica in saprolite, it is predominantly recovered in the rotary kiln-electric furnace (RKEF) process in which the ore is partially reduced and then melt in submerged electric arc furnace to produce ferronickel (20-30%Ni).

Nickel pig iron (NPI) has been developed as a lower nickel substitute (1-15%Ni) but cheaper alternative when pure nickel price was high. It was initially produced from China through small blast furnace to solve the issue of shortage in natural nickel resource. [2, 3] With the strict environmental policy, the development of blast furnace based NPI has been limited. Later, electric arc furnace (EF) and rotary kiln and electric furnace (RKEF) process has been introduced into China.

BF-based NPI is nowadays mainly processing low grade laterite ores, for example, process limonite (Ni<1.5%, Fe>40%) from Philippines into low grade NPI (1.6-4%Ni), or saprolite (Ni>1.5%) from Indonesia into middle grade NPI (4-8%). Saprolite (Ni>1.5%) from Indonesia is typically process through EF or RKEF process to produce high grade NPI (8-15%).[3] Compared to BF and EF process, RKEF process becomes more and more popular because it pre-reduces laterite ore in rotary kiln which lowers its energy consumption and production cost. In 2019, RKEF based NPI production accounts for 85% in China [4], see figure A1.

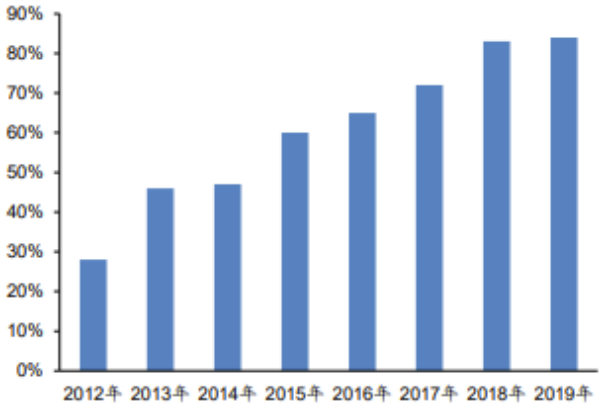


Figure A1 Chinese NPI production ratio from RKEF process during 2012-2019 [4] (non-original source)

In 2014, Indonesia banned exports of nickel ore which forces miners to process ore locally to realize value addition in nickel production. This brings a relocation of NPI plants from China to Indonesia. In

[1] Crundwell, F.K. etc. Extractive Metallurgy of Nickel, Cobalt and Platinum Group Metals; Elsevier, 2011 2. .
[2] Rao, M, etc. Carbothermic Reduction of Nickeliferous Laterite Ores for Nickel Pig Iron Production in China: A Review. JOM 2013
[3] P Prasetyo, 2018 IOP Conf. Ser.: Mater. Sci. Eng. 285 012015
[4] Guosen Securities, Specials of non-ferrous industry: The revolution of nickel supply and demand (in Chinese) (2021) Accessed on 2022-01-24, web link

2020, Indonesian NPI production (613000 tonne Ni) exceeded China and the first time became the world's largest NPI producer (figure A2).[4]

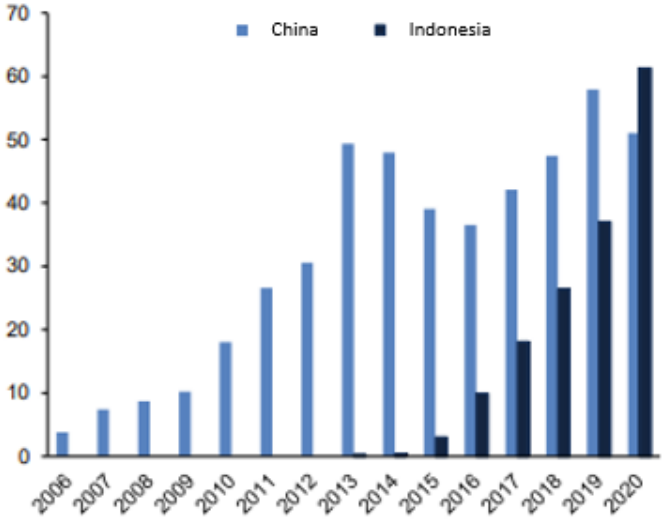


Figure A2. NPI production in China and Indonesia during 2006-2020, Unit: 10 000 tonne Ni (Adjusted from reference [4], non-original source)

As the world's largest stainless steel producer, China has reached a stainless steel production of 29.5 Mt in 2020. Among this, 200 series and 300 series steel is 32.43% and 49.68%, respectively. Ni is mainly consumed in 300 series in comparison to other series due to a nickel grade requirement in products.[5]

Among different nickel alternatives, nickel pig iron is the main nickel source due to its high economic efficiency in process. NPI can take up to 50% of the total material feed. The rest nickel source is from stainless steel scrap and FeNi, sometimes also use pure nickel to adjust the composition (figure A3).

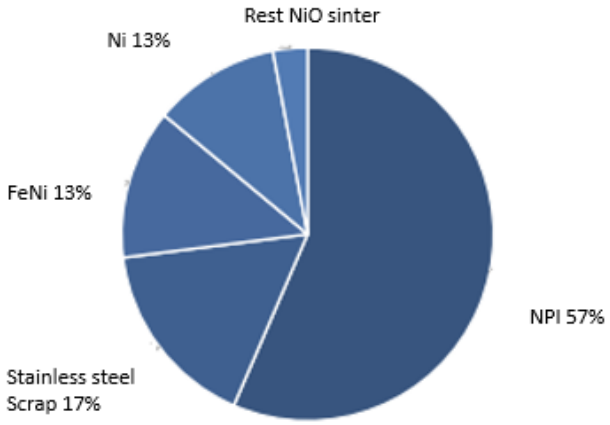


Figure A3. Nickel sources in raw materials of stainless steel production in China in 2020 (Adjusted from reference [4], non-original source)

Estimation of region-based Ni alloys

Five nickel sources are selected in this study to further assess in stainless steel plant. They are described in table A1. The origins refer to the statistic of FeNi/NPI production, import and export

[5] Cinda Futures, Special report: Details of Nickel demand-Stainless steel supply(in Chinese) (2021) Accessed on 2022-01-24 , web link

between 2020 and 2021 (table A2). Carbon footprints of these five nickel alloys are calculated through process models based on mass and energy conservation which developed from earlier published work[6] . Some input data [7,8,9]such as ore/alloy composition, fuel type, electricity source is updated from previous process model and adjusted to make it more current case related.

Nickel alloy grade used in this study is assumed as a fixed value depending on the nickel alloy type (see table A1. The inventory of these four nickel alloys and corresponding emission factors are summarised in table A3 and table A4, respectively. In the operation, alloy grade can be different depending on the suppliers. For instance, the FeNi used in EU stainless steelmaking may have a nickel content between 16-42% (refer to table 2 in main text), in this study FeNi with a nickel content of 28% is used in model calculation. This may also bring uncertainty of material's carbon footprint.

Table A1 Carbon footprint of nickel alloys (unit: $kgCO_2$-eq/kg alloy)

	Ore Ni%	Alloy Ni%	1kg alloy	1kg Ni	Comment
Ni	2.05	100	11.7	11.7	Flash furnace, produced in Australia, electricity is country average
FeNi (EU average)	1.44	28.29	17.2	60.9	Electricity emission factor (0.329$kgCO_2$/kWh) is assumed as 45% Brazil+19% New caledonia+18% Greece+18% UK, representing FeNi origins in EU (Table A3)
NPI (China average)		12.14	10.6	87.2	RKEF, Emission factor is weight average of 60% NPI-Indonesia average+40%NPI-China (Table A3)
NPI (Indonesia average)	1.90	12.75	11.2	87.5	RKEF, produced in Indonesia, coal-based electricity (1$kgCO_2$/kWh)
NPI-China	1.90	11.73	10.2	87.1	RKEF, produced in China with ore from Philippines, electricity emission factor is weight average from NPI production regions, representing 67% of NPI production in China. (0.866$kgCO_2$/kWh)

Table A2 Production, Import and Export of FeNi/NPI in EU, China and Indonesia (unit: kt)

	EU-27	China	Indonesia
Reference year	2020	2021	2020
Production [1-2]	Total: 25 Greece: 21 (Assume FeNi, 28% Ni)	Total: 5036	Total: 4862 (Assume NPI, 13% Ni)
Import [3]	Total: 199 Brazil: 55 New Caledonia: 23 UK: 22	Total: 3701 Indonesia: 3117	Total: 0
Export [3]	2	0.4	Total: 2874 China: 2781
[1] INSG, Primary Nickel Production, 2022, accessed through EUROFER [2] ISSF, Study of Chinese Stainless Steel Production (EXCEL), 2021, accessed through EUROFER [3] World Integrated Trade Solution, 2022, available online: weblink (accessed on 2022-06-14)			

[6] Wei, W.; Samuelsson, P.B.; Tilliander, A.; Gyllenram, R.; Jönsson, P.G. Energy Consumption and Greenhouse Gas Emissions of Nickel Products. Energies, 2020,

[7] Pan L. etc. Discussion of the improvement on the laterite nickel ore RKEF production technology (in Chinese), (2017), Ferro alloys, 1

[8] Zhang Y., etc. Analysis of Producing Hot metal with low Ni content in Blast Furnace with Laterit (2007), China Iron and Steel Annual Conference (in Chinese).

[9] Warner, A.E.M., Díaz, C.M., Dalvi, A.D. et al. JOM world nonferrous smelter survey, part III: Nickel: Laterite. JOM 58, 11–20 (2006).

Table A3 Calculated inventory of four nickel alloys (Function unit: 1t nickel alloy)

Process	Ni (100%)	FeNi (28%)	NPI (12.75%Ni)-Indonesia	NPI (11.73%Ni)-China
Mining	Sulfidic Ore: 11797 kg Diesel: 3640MJ Electricity: 2283 kWh El.(beneficiation):3064 kWh	Laterite ore: 27800 kg Diesel: 6066MJ Electricity: 67 kWh	Laterite ore: 10645 kg Diesel: 6066 MJ Electricity: 67 kWh	Laterite ore: 9893 kg Diesel: 6066 MJ Electricity: 67 kWh *Transport: (sea 4000km)* Diesel: 4749MJ
Pre-process	*Drying:* Off gas heat: 8182 MJ Transport: (truck 400km) Diesel: 3901 MJ	*Drying:* Diesel: 5671 MJ *Calcination:* Diesel 66038MJ Woodchips: 4083 kg	*Drying:* Coal: 248 kg *Calcination:* Coal 468 kg Coke: 452 kg	*Drying:* Coal: 230kg *Calcination:* Coal 436 kg Coke: 441 kg
Smelting	Blast (Air): 10057 Nm^3 Oxygen: 342 Nm^3 Silica: 2236 kg Dust: 1524 kg Diesel: 6234 MJ Coal: 408 kg	Electricity: 8031 kWh Electrode: 61 kg	Electricity: 4537 kWh Electrode: 8.5 kg Lime: 1800 kg	Electricity: 4285 kWh Electrode: 7.92 kg Lime: 1670 kg
Post-process	*Settling:* Coke: 316 kg Electricity: 695 kWh Electrode: 1.81 kg *Converting:* Silica: 293 kg Transport: (truck 644 km) Diesel: 990 MJ *Refining:* Ammonia: 637 kg H_2: 70kg Electricity: 2900 kWh Natural Gas: 18500 MJ	*Refining:* Lime: 1 kg O2: 1 Nm^3 FeSi: 2.8 kg Al: 6 kg Electricity: 1486 kWh	*Refining:* O2: 19 Nm^3 FeSi: 2.8 kg Al: 6 kg Electricity: 1255 kWh	*Refining:* O2: 19 Nm^3 FeSi: 2.8 kg Al: 6 kg Electricity: 1275 kWh

Table A4. Conversion factor of inventory (unit: kg CO_2-eq/unit)

Source	Emission Factor	Comment
Electricity-Indonesia	1 kgCO_2-eq/kWh	Coal-based [1]
Electricity-China	0.866 kgCO_2-eq/kWh	Electricity emission factor is weight average from NPI production regions, representing 67% of NPI production in China. (0.866kgCO_2/kWh) [2-3]
Electricity (EU, FeNi)	0.329 kgCO_2-eq/kWh	Electricity emission factor (0.329kgCO_2/kWh) is assumed as 45% Brazil+19% New caledonia+18% Greece+18% UK, representing FeNi origins in EU
Electricity- Philippine	0.4875 kgCO_2-eq/kWh	[4]
Electricity-Australia	0.703 kgCO_2-eq/kWh	Estimated based on energy source in 2021: 67% Coal, 6% gas, 9% hydro, 13% wind, 6% solar [5]
Electricity-Brazil	0.147 kgCO_2-eq/kWh	Estimated based on energy source in 2020: 66% hydro +11% solar+12% fossil fuel+8% biomass+2% nuclear [6]
Electricity-Greece	0.479 kgCO_2-eq/kWh	EEA [7]
Electricity-New Caledonia	0.716 kgCO_2-eq/kWh	Estimated based on energy source in 2018: 41% Coal+ 38.7% oil+9.1% hydro+ 7.8% diesel+ 2.6% biomass [8]
Electricity-UK	0.225 kgCO_2-eq/kWh	EEA [7]
Diesel (transport)	0.0752 kgCO_2-eq/MJ [	IPCC [9]
Diesel (combustion)	0.0743 kgCO_2-eq/MJ	IPCC [9]
Natural Gas	0.0562 kgCO_2-eq/MJ	IPCC [9]
Coal	0.0953 kgCO_2-eq/MJ	IPCC [9]
Coke	0.1077 kgCO_2-eq/MJ	IPCC [9]
Wood chips (Brazil)	0.1187 kgCO_2-eq/MJ	IPCC [9]
Truck freight	0.08 kgCO_2-eq/tkm	IPCC [9]
Ship freight	0.009 kgCO_2-eq/tkm	IPCC [9]
Electrode	3.663 kgCO_2-eq/kg	IPCC [9]
Ammonia	2.104 kgCO_2-eq/kg	IPCC [9]
Hydrogen	9.71 kgCO_2-eq/kg	[10]
Oxygen	0.165-0.5 kg CO_2-eq/Nm^3	0.5kWh/Nm^3 [11]
Silica	0.09 kgCO_2-eq/kg	[12]
Lime	0.95 kgCO_2-eq/kg	[13]
FeSi	4.004 kgCO_2-eq/kg	[9]
Aluminium	6.7 kgCO_2-eq/kg	[14]

[1] UK Parliament. Carbon Footprint of Electricity Generation (Postnote). 2006. Available online: weblink (accessed on 2020-09-13)
[2] Ministry of Ecology and Environment of the People's Republic of China, Greenhouse gas emissions accounting methods and Reporting Guidelines for Power Generation Facilities, 2019, weblink (accessed 2022-06-14)
[3] Top 10 producers of high grade nickel pig iron in China in 2021(in Chinese), 2022, weblink
[4] Republic of the Philippines, Department of environment and natural resources, Additional information on calculation the emission factors of the Philippines for the JCM.
[5] Australian Government, Generation capacity and output by fuel source-NEM, 2022. Available: Link (2022-06-21)
[6] EIA, Hydropower made up 66% of Brazil's electricity generation in 2020, 2021. Available online: weblink
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[9] IPCC. 2006 IPCC Guidelines for National Greenhouse Gas Inventories. 2006.
[10] Marquevich, M.; Sonnemann, G.; Castells, F. Life cycle inventory analysis of hydrogen production by the steam-reforming process: Comparison between vegetable oils and fossil fuels as feedstock. Green Chem. 2002, 4, 414–423
[11] Private communication, Joachim von Schéele, Linde Gas, electricity consumption for process gas (2022)
[12] Grbeš, A. A Life Cycle Assessment of Silica Sand: Comparing the Beneficiation Processes. Sustainability 2015, 8,
[13] Worldsteel Association, CO_2 data collection-User Guide, version 10 (2021)
[14] European Aluminium. Environmental Profile Report, Ife-cycle inventory data for aluminium production and transformation processes in Europe, 2018. Available online weblink (accessed on 2022-06-22)

Appendix B Carbon footprint of region-based HC FeCr

The average carbon footprint of high carbon ferrochrome (HC FeCr) in EU, China and Indonesia region is given in table B1 and calculated as the upstream emission or scope 3 when estimating the carbon footprint of 304 grade stainless steelmaking.

The average emission factor is dependent on the production technology and the electricity emission factor of the manufacture. The origins of HC FeCr refer to the statistic of HC FeCr production, import and export between 2020 and 2021 (table B2).

The inventory data of this study is collected from publicly available facility data (table B3), which can have their own limitations, including uncertainty on the recent status of the process technology and inventory data. In addition, HC FeCr used in this study is assumed as 53% Cr, independent of the production location. In the operation, Cr content in FeCr can vary between 50%-70% % (refer to table 2 in main text) which may also bring uncertainty of material's carbon footprint.

Table B1 Carbon footprint of HC FeCr (unit: $kgCO_2$-eq/kg FeCr)

HC FeCr (53%Cr)	Emission factor	Comments
FeCr (EU average)	2.83	Assume 48% Finland+ 37% South Africa+ 15% Sweden based on Table B2
FeCr (China average)	5.7	Assume 75% China+17% South Africa+ 8% Kazakhstan based on Table B2
FeCr (Indonesia average)	4.97	Assume 64% South Africa+23% Indonesia+ 13% Kazakhstan based on Table B2
FeCr (Finland)	1.6	Closed submerged arc furnace with preheating process, emission factor is from private communication
FeCr (South Africa)	4.76	Assume closed submerged arc furnace with preheating process. Electricity emission factor is on average in South Africa.
FeCr (China)	5.82	Assume open/semi closed submerged arc furnace process. Electricity emission factor is weight average of top ten HC FeCr production regions in China
FeCr (Kazakhstan)	6.6	Assume DC arc furnace process. Electricity emission factor is on country average level.
FeCr (Sweden)	2.03	Assume semi-closed submerged arc furnace process. Electricity emission factor is on country average level.
FeCr (Indonesia)	4.65	Assume closed submerged arc furnace +Prereduction process and the electricity is coal-powered.

Table B2 Production, Import and Export of HC FeCr in EU-27, China and Indonesia (unit: kt)

	EU-27	China	Indonesia
Reference year	2020	2021	2020
Production [1]	Total: 601 Finland: 498 Sweden: 87	Total: 5929 [3]	Total: 190
Import [2]	Total: 370 South Africa: 216 Kazakhstan: 44	Total: 2627 South Africa: 1290 Kazakhstan: 634	Total: 776 South Africa: 540 Kazakhstan: 113
Export [2]	222	74	0
[1] USGS, Minerals Yearbook Chromium (XLS Format), 2020, available online: weblink (accessed on 2022-06-14) [2] World Integrated Trade Solution, 2022, available online: weblink (accessed on 2022-06-14) [3] Top ten HC FeCr manufactures in China in 2021 (in Chinese), 2022. Available onlin: weblink (accessed on 2022-03)			

Table B3 The inventory of High Carbon Ferrochrome production in different process technologies

Process Technology	Unit	Open/Semi-closed submerged arc furnace (SAF)	Closed SAF+preheating (CSAF+PH)	Closed SAF+preheating (CSAF+PR)	DC arc furnace (DCAF)
Reductant-coke	kg	625	525	600	788
Coal	kg			250	201
Chromite ore	kg	2700	2350	1850	1925
Electrodes	kg	17	9	20	
Silica	kg	250	250	150	210
Limestone	kg			300	175
Bentonite	kg			60	
Electricity	kWh	4150	3300	1950	4250
Reference		[4]	[4]	[5]	[5]

[4] Klingspor; M.; Stripple, H.Swedish Environmental Research Institute,A Nordic contribution concerning the revision of the IPPC Reference Document on Best Available Techniques in the Non Ferrous Metals Industries. 2008, Available online: weblink (accessed on 2022-06-13).
[5] USGS.Chromium life cycle study. 1995, Available online: weblink (accessed on 2022-06-21)

Table B4 Emission factor for calculating carbon footprint of HC FeCr

Emission factor	Unit	Amount	Comment
Coke	kg	3.07	IPCC [6]
Coal	kg	2.62	IPCC [6]
Ore	kg	0	
Electrodes	kg	3.663	IPCC [6]
Silica	kg	0.05	Estimated based on 0.02 MJ electricity and 0.046 MJ/kg diesel, using coal-powered electricity (1kgCO_2/kWh). [7-8]
Limestone	kg	0.4	IPCC [6]
Bentonite	kg	0.04	[7]
Electricity (South Africa)	kWh	0.94	South Africa's Grid Emission Factor, 2013 [10]
Electricity (China)	kWh	0.922	Weight average of top 10 HC FeCr production regions (mainly in Shanxi, Inner Mongolia, Hunan etc.) in China, accounting for 50% of the total FeCr production in China. [3] The regional emission factor of grid mix in China is referring to the government document in 2019. [11]
Electricity (Kazakhstan)	kWh	0.84	[12]
Electricity (Sweden)	kWh	0.0088	EEA [13]
Electricity (Indonesia)	kWh	1	Assume coal powered

[6] IPCC, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, 2006. Available online: weblink (accessed on 2020-09-13).
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[11] Ministry of Ecology and Environment of the People's Republic of China, Greenhouse gas emissions accounting methods and Reporting Guidelines for Power Generation Facilities, 2019, available online: weblink (accessed 2022-06-14)
[12] Green Climate Fund, GCF-EBRD Kazakhstan Renewables Framework. 2017, Available online: weblink (accessed 2022-06-21)
[13] EEA, Greenhouse gas emission intensity of electricity generation by country, 2021. Available from weblink (accessed on 2022-06-21)

Appendix C Carbon footprint of region-based FeSi

The average carbon footprint of ferrosilicon (FeSi) in EU, China and Indonesia region is given in Table C1 and calculated as the upstream emission or scope 3 when estimating the carbon footprint of 304 grade stainless steelmaking. The average emission factors are estimated based on the same inventory. The main difference is the electricity emission factor applied which is dependent on the origins of FeSi (table C2).

The inventory data of this study is collected from publicly available data (table C3), which can have their own limitations, including uncertainty on the recent status of the process technology and inventory data. The FeSi used in this study is assumed as 76% Si, independent of the production location. In the operation, Si content in FeSi can vary between 58-76% % (refer to table 2 in main text) which may also bring uncertainty of material's carbon footprint.

Table C1 Carbon footprint of region-based FeSi (unit: $kgCO_2$-eq/kg FeSi)

FeSi (76%Si)	Emission factor	Comments
FeSi (EU average)	4.65	54%Nowrway+25% Spain+21% Poland, the weight average is described as grid mix emission factor.
FeSi (China average)	10.84	Produced in China, electricity emission factor is using the grid mix in North China Region (0.942 $kgCO_2$/kWh)
FeSi (Indonesia average)	10.84	Imported from China

Table C2 Production, Import and Export of FeSi in EU, China and Indonesia in 2020 (unit: kt)

	EU	China	Indonesia
Production [1]	Total: 206 Spain: 77 Poland: 64	Total: 5300	Total: 0
Import [2]	Total: 344 Norway: 216	Total: 22	Total: 37 China: 33
Export [2]	45	257	2
[1] USGS, Minerals Yearbook Silicon (XLS Format), 2020, available online: weblink (accessed on 2022-06-14) [2] World Integrated Trade Solution, 2022, available from https://wits.worldbank.org/Default.aspx?lang=en (accessed on 2022-06-14)			

Table C3 Inventory of FeSi (76%Si) production [3]

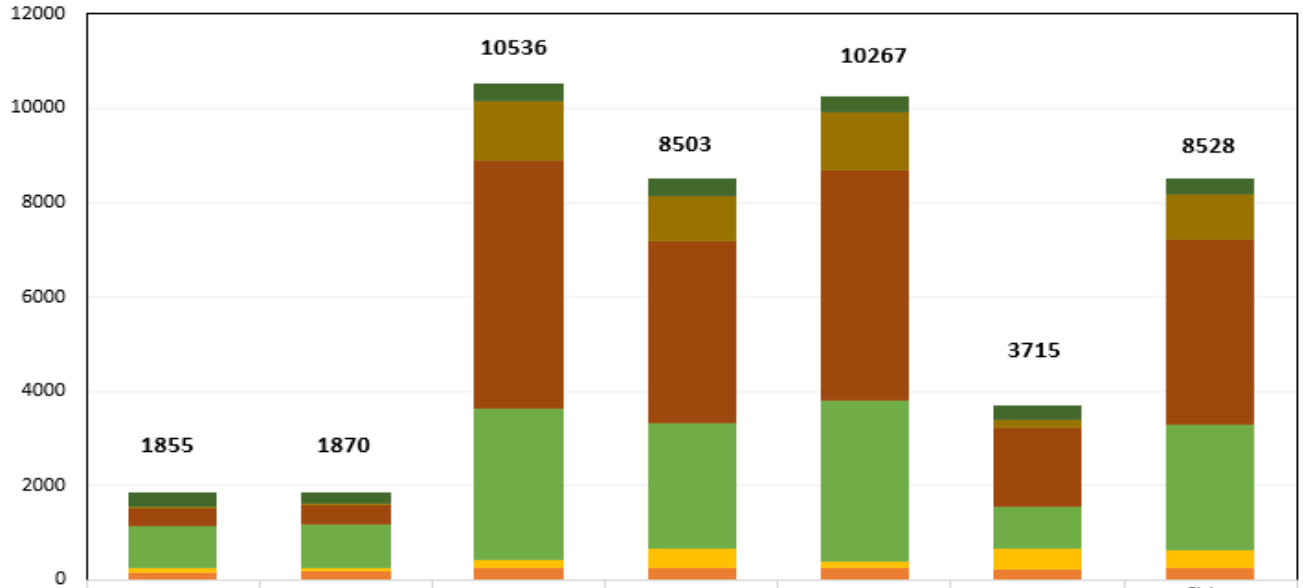
Inventory	Unit	Amount
Electricity (Pelletising)	kWh	0.3975
Limestone (Pelletising)	kg	4.77
Dolomite (Pelletising)	kg	21.2
Coke (Pelletising)	kg	2.12
Bentonite (Pelletising)	kg	2.65
Electricity (Pellet induration)	kWh	11.925
Fuel (Pellet induration)	MJ	198.75
Silica	kg	1501
Coke	kg	408
Coal	kg	541
Electrode	kg	63
Electricity	kWh	8300
Bentonite	kg	0.040
[3] Nawshad Haque et.al, Estimation of greenhouse gas emissions from ferroalloy production using life cycle assessment with particular reference to Australia, Journal of Cleaner Production,39,2013,220-230		

Table C4 Emission factors used to estimate carbon footprint of region-based FeSi ($kgCO_2$-eq/unit)

Source	Unit	Amount	Comment
Electricity (EU average, FeSi)	kWh	0.197	54% Norway+25%Spain+21% Poland
Electricity (China, FeSi)	kWh	0.942	North China Region [4]
Electricity (Norway,2016)	kWh	0.016	[5]
Electricity (Spain, 2020)	kWh	0.156	EEA [6]
Electricity (Poland, 2020)	kWh	0.710	EEA [6]
Electrode	kg	3.663	IPCC [7]
Coke	kg	3.069	IPCC [7]
Coal	kg	2.620	IPCC [7]
Silica	kg	0.05	Estimated based on 0.02 MJ electricity and 0.046 MJ/kg diesel, using coal-powered electricity ($1kgCO_2$/kWh). [8-9]
Natural gas	MJ	0.056	IPCC [7]
Limestone	kg	0.440	IPCC [7]
Dolomite	kg	0.476	Worldsteel [10]
Bentonite	kg	0.040	[11]
[4] Mistry of Ecology and Environment of the People's Republic of China, Greenhouse gas emissions accounting methods and Reporting Guidelines for Power Generation Facilities, 2019. [5] The Norwegian Energy Regulatory Authority (NVE-RME), Electricity disclosure 2016, 2018. Available online: weblink (Accessed on 2022-06-21) [6] EEA, Greenhouse gas emission intensity of electricity generation by country, 2021. Available online: weblink (accessed on 2022-06-21) [7] IPCC, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, 2006. Available online: https://www.ipcc-nggip.iges.or.jp/public/2006gl/ (accessed on 2020-09-13). [8] Mitterpach, J.; Hroncová, E.; Ladomersky, J.; Balco, K. Identification of Significant Impact of Silicon Foundry Sands Mining on LCIA. Sustainability 2015, 7, 16408–16421 [9] Grbeš, A. A Life Cycle Assessment of Silica Sand: Comparing the Beneficiation Processes. Sustainability 2015, [10] Worldsteel Association, CO_2 data collection-User Guide, version 10 (2021) [11] Athanassopoulos;, C.; Vamos, R.J.,Carbon footprint comparison of GCLs and Compacted clay liners. 2011			

Appendix D Breakdown for scope 3 emission

Actual and modelled carbon footprint for 1 t 304 black coil in EU, Indonesia and China (kg CO_2-eq)



	EU(actual)	EU	Indonesia	China a	China b	China c	China (Average)
Rest Scope 3**	292	247	375	375	367	329	371
Scope 3 of Scope 3*	49	52	1272	933	1208	166	936
Scope 2 of Scope 3*	373	387	5246 ***	3874	4878	1682	3915
Scope 1 of Scope 3*	897	913	3215	2659	3412	865	2682
Scope 2	89	90	165	404	137	447	366
Scope 1	155	180	263	258	265	226	257
	Plant Data	Model	Model	Model	Model	Model	80%a+15%b+5%C

* Scope 1/Scope 2/Scope 3 of Scope 3 is the breakdown for the production of Ni alloys, FeCr and FeSi

**Rest Scope 3: including raw materials used in steelmaking but not be able to breakdown due to the integrated value from original data source, e.g. Al, SiMn , scrap etc.

***For the Indonesia case, the total emission from Scope 2 of Scope 3 is 5246 kgCO_2-eq. Among this, 4134 kgCO_2-eq is generated from the captive coal-fired power plant for NPI production.

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für Wirtschaft
und Klimaschutz

Industriepolitik in der Zeitenwende

Industriestandort sichern, Wohlstand erneuern, Wirtschaftssicherheit stärken

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A. Vorwort

Die deutsche Industrie steht unübersehbar vor großen Herausforderungen. Der russische Angriffskrieg auf die Ukraine markiert eine Zeitenwende, wie sie der Bundeskanzler gleich zu Kriegsbeginn auf den begrifflichen Punkt gebracht hat. Mit den anhaltend höheren Energiepreisen hat diese Zeitenwende bereits sehr handfeste Auswirkungen. Und sie ist nur der aktuellste Ausdruck einer tiefgreifenden Veränderung der internationalen geopolitischen und -ökonomischen Wirklichkeit, die auch für die deutsche Industrie große Veränderungen mit sich bringt, zum Beispiel beim sicheren Zugang zu Rohstoffen. Dazu kommt: Die Transformation zur Klimaneutralität und die damit verbundene Erneuerung unseres Wohlstandes birgt mittel- und langfristige Chancen, verursacht im Übergang aber auch große Anstrengungen und Kosten für die Industrie und ihre Beschäftigten. Schließlich haben sich die Standortbedingungen bereits über eine lange Zeit auch deshalb verschlechtert, weil notwendige Reformen und Investitionen ausgeblieben sind: Der Ausbau der Erneuerbaren Energien wurde vernachlässigt, die Infrastruktur nicht erneuert, gefährliche Abhängigkeiten wurden zementiert oder sogar neu geschaffen, die Bürokratie ist ausgeufert, der Fachkräftemangel wurde nicht entschieden angegangen.

Deutschland hat eine lange Tradition als starkes Industrieland. Ich will, dass das so bleibt. Deshalb gilt es jetzt, unsere industrielle Stärke als Kraft der Erneuerung für zukünftige Wertschöpfung und Arbeit einzusetzen. Ich bin mir sicher: Wir können und wir werden den Industriestandort wieder stärken und so unseren Wohlstand erneuern. Zuversicht gibt mir zuallererst die Industrie selbst: ihre erstklassigen Produkte, die auf der ganzen Welt begehrt sind. Ihre vielfältige Zusammensetzung, von Weltkonzernen bis zu den hunderten mittelständischen Hidden Champions und tausenden kleinen Betrieben überall im Land. Ihre starke Innovationskraft und die Verzahnung mit der exzellenten Forschungslandschaft in Deutschland. Die Millionen hochqualifizierten Beschäftigten. Die Kultur der vertrauensvollen Zusammenarbeit zwischen Betriebsräten und Unternehmensleitungen.

Aber die Herausforderungen, vor denen die Industrie steht, fordern auch uns als Politik. Diese Bundesregierung hat seit ihrem Amtsantritt die Industrie in das Zentrum ihres Handelns gestellt: Wir haben die Bremsen beim Ausbau der Erneuerbaren Energien gelöst. Gemeinsam mit den Unternehmen und den Verbraucherinnen und Verbrauchern haben wir eine drohende Gasmangellage abgewendet und in Rekordtempo eine Flüssiggasinfrastruktur aufgebaut. Wir haben ein umfassendes Paket zur Dekarbonisierung der deutschen Industrie auf den Weg gebracht. Wir haben die Einwanderung von Fachkräften erheblich erleichtert. Die Investi-

tionen in die Infrastruktur wie Schiene und Straße steigen. Die Blockade beim Handelsabkommen CETA ist aufgelöst. Und mit einem einzigartigen Förderpaket stärken wir Deutschland als wichtigsten europäischen Produktionsstandort für Halbleiter.

Noch mehr ist bereits auf dem Weg: Die steuerlichen Rahmenbedingungen gerade für Investitionen in Klimaschutz und Innovation werden durch das Wachstumschancengesetz erheblich verbessert. Das Wasserstoffkernnetz steht in den Startlöchern.

Doch es bleiben zentrale Aufgaben: Die Brücke für energieintensive Unternehmen steht noch nicht, um sicher ans andere Ufer eines wettbewerbsfähigen Industriestroms aus Erneuerbaren zu kommen. Es braucht einen regulativen Rahmen für die Abscheidung, Nutzung und Speicherung von CO_2. Beim Abbau unnötiger Bürokratie und bei der Beschleunigung von Planungs- und Genehmigungsverfahren besteht noch erheblicher Handlungsbedarf. Bei den notwendigen Konsequenzen aus der veränderten internationalen Lage bleibt viel zu tun.

Zugleich gibt es eine kontroverse gesellschaftliche Debatte darüber, welche Rolle dem Staat bei der Unterstützung der Industrie zukommt. Viele Maßnahmen, wie die Ansiedelungspolitik für Halbleiterfabriken oder der Brückenstrompreis, sind umstritten. Von einigen wird angeführt, es sei besser, die Marktkräfte ungehindert walten und die Kraft der schöpferischen Zerstörung ungebremst wirken zu lassen. Angesichts der massiv veränderten Rahmenbedingungen sei selbst eine Verlagerung der Grundstoffindustrie ins Ausland sinnvoll. Von anderen wird ein scharfer Gegensatz zwischen Großkonzernen und Mittelstand konstruiert, aus dem heraus eine Unterstützung besonders unter Druck geratener Teile der Industrie als Benachteiligung abgelehnt wird. Schließlich wird die Industrie von einigen wegen ihrer (immer noch großen) Auswirkungen auf Klima und Umwelt in Frage gestellt.

In Anbetracht dieser gesellschaftlichen Debatte heißt Industriepolitik auch, das Bewusstsein für die Bedeutung industrieller Stärke für wirtschaftliche Prosperität, gute Arbeit, soziale Teilhabe und gesellschaftlichen Zusammenhalt zu schärfen und unsere Maßnahmen immer wieder aufs Neue klar und verständlich zu begründen.

Für mich ist klar: Unser Wohlstand und die gesellschaftliche Wohlstandsteilhabe sind aufs Engste mit industrieller Produktion verknüpft. Die Bedeutung der Industrie geht deshalb weit über das Ökonomische hinaus. Sie trägt entscheidend bei zum sozialen Zusammenhalt unserer Gesellschaft und auch zu ihrer demokratischen Stabilität.

Die Industrie ist Teil der sozialen und kulturellen Identität unseres Landes; sie ist tief in Lebensformen und Arbeitsbiographien eingeschrieben. Das gilt nicht nur für ihre Erfindungen, ihre Produkte und Markennamen. Unsere gesamte Ordnung der Sozialen Marktwirtschaft ist stark mit der Industrie verwoben. Die Zuwächse an Aufstiegschancen und materieller Teilhabe, die Gewerkschaftsbewegung, die Sozialpartnerschaft, die betriebliche Mitbestimmung, all das hatte ihren Anfang in der Industrie und es prägt sie und unser Land bis heute.

Die Industrie lässt aus Wohlstand Wohlstandsteilhabe werden. Sie bietet gute Arbeitsplätze und Einkommen für breite Schichten unserer Gesellschaft – vom Facharbeiter bis zur IT-Entwicklerin. Oft sind es Betriebe und Arbeitsplätze, die ganze Familien und Regionen prägen. Damit ist die Industrie auch heute – in einer Zeit von Unsicherheit und Sorge – ein Eckpfeiler für die soziale und gesellschaftliche Stabilität in unserem Land. Sie ist auch entscheidend für unsere Sicherheit und strategische Souveränität in einer riskanter gewordenen Welt, in der wir die notwendigen Kompetenzen und Schlüsseltechnologien hier in Europa brauchen.

Diese Debatten führen wir nicht nur in Deutschland – wir führen sie auch mit unseren Partnern in der Europäischen Union, weil sich Industriepolitik in einem politisch und ökonomisch tief integrierten Europa nur europäisch denken lässt. Und weil unsere Industriepolitik wirtschafts- wie auch sicherheitspolitisch in den Rest der EU ausstrahlt. Damit kommt uns als größtem Mitgliedstaat auch eine besondere Verantwortung zu, unsere Politik zu begründen und in die europäische Strategie einzubetten.

All dem dient die vorgelegte Industriestrategie. Sie kontextualisiert und begründet wichtige Entscheidungen der Bundesregierung und legt dar, wie diese fortgeführt und weiterentwickelt werden sollen.

Die Strategie hat dabei ein klares Leitbild: Deutschland soll als starker Industriestandort inklusive Grundstoffindustrie in Zeiten der Umbrüche bewahrt bleiben und gleichzeitig wichtiger Standort für Zukunftsindustrien – von Halbleitern bis Transformationstechnologien – werden. Dies dient zwei Zielen: Der Erneuerung von Wohlstand und Wohlstandsteilhabe und der Stärkung der deutschen und europäischen Wirtschaftssicherheit unter den Bedingungen von Zeitenwende und Klimakrise.

Unsere industrielle Zukunft zu stärken setzt voraus, dass wir uns den veränderten und sich weiter verändernden Bedingungen stellen. Dies tun in erster Linie die vielfältigen Akteure der Industrie selbst, durch ihre Anstrengung, durch ihre Kraft zur Innovation. Dieser Aufgabe stellt sich aber auch die Politik. Dabei wissen beide Sphären, Wirtschaft und Politik, dass es für das Gelingen – bei allem notwendigen Ringen – auf das Zusammenspiel ankommt.

Dr. Robert Habeck
Bundesminister für Wirtschaft und Klimaschutz

B. Die Kraft der Industrie für Deutschland

1. Strukturmerkmale der deutschen Industrie

Deutschland ist ein starkes Industrieland im Herzen der EU und kann dabei auf eine lange Erfolgsgeschichte zurückblicken. Diese Stärke liegt zuallererst in den vielen innovativen und produktiven Unternehmen selbst sowie der Leistung der Arbeitnehmerinnen und Arbeitnehmern begründet.

Wesenskern der deutschen Industrie ist ihre Vielfalt. Zu oft wird Industrie gleichgesetzt mit einigen wenigen Großkonzernen. Die gibt es, aber ebenso gibt es die vielen Mittelständler und Familienunternehmen überall im Land. 90 Prozent aller Unternehmen im Verarbeitenden Gewerbe sind kleine und mittelständische Firmen mit weniger als 250 Beschäftigten. Deutschland ist das Land der Hidden Champions.

Auch die Branchen- und Produktpalette ist ausgesprochen vielfältig. Das öffentliche Bild der deutschen Industrie ist geprägt von Autos und Chemie, von Pharma und Maschinen. Diese vier Branchen generieren einen jährlichen Umsatz von rund 1,2 Billionen Euro. Insgesamt arbeiten dort etwa 3 Millionen Beschäftigte. Die deutsche Industrie liefert aber noch mehr als das: Papier und Glas, Elektro und Optik, Textil und Zement, Bau und Stahl, Rüstung und Recycling, Windkraftanlagen und Wärmepumpen, Flugzeuge und Fahrräder, Hard- und Software. Auch wächst die Bedeutung industrienaher Dienstleistungen: Unter dem Stichwort Servitization werden mit fortschreitender Digitalisierung aus reinen Produktlieferanten Anbieter von Gesamtlösungen. Innerhalb des Verarbeitenden Gewerbes sind bereits mehr als 40 Prozent der Beschäftigten in Dienstleistungsberufen tätig. Zusätzlich spielen Unternehmen im Dienstleistungsbereich zunehmend eine wichtige Rolle für eine starke und innovative Industrie: Sie liefern beispielsweise Daten, digitale Anwendungen oder fortschrittliche Kommunikationstechnologien.

Die Industrie in Deutschland ist auch regional breit verteilt. Überall im Land gibt es kleine und mittelständische Unternehmen, die ihre Städte und Regionen prägen. Im Norden, Osten, Süden und Westen des Landes gibt es industrielle Cluster mit Schwerpunkten auf Fahrzeug- und Maschinenbau, Flugzeugen und chemischen Produkten, elektrischer Ausrüstung und Optik. Der Osten konnte zuletzt diverse Ansiedlungen im Bereich der Hochtechnologie verzeichnen. Hier ist der größte europäische Produktionsstandort für Mikrochips entstanden. Weitere wegweisende Halbleiter-Ansiedlungen sind geplant. Und auch im Bereich Elektromobilität entsteht ein neues Wertschöpfungszentrum im Osten.

Zentral ist zudem die enge Verflechtung der Industrie im europäischen Binnenmarkt. In jedem von den deutschen Industrieunternehmen erlösten Euro ist etwa ein Siebtel an Vorprodukten aus der EU enthalten. Zugleich ist die EU für deutsche Exporte mit über der Hälfte der Ausfuhren die wichtigste Destination. Der Erfolg des Industriestandorts Deutschland ist aufs Engste mit der wirtschaftlichen und politischen Integration in der EU verknüpft.

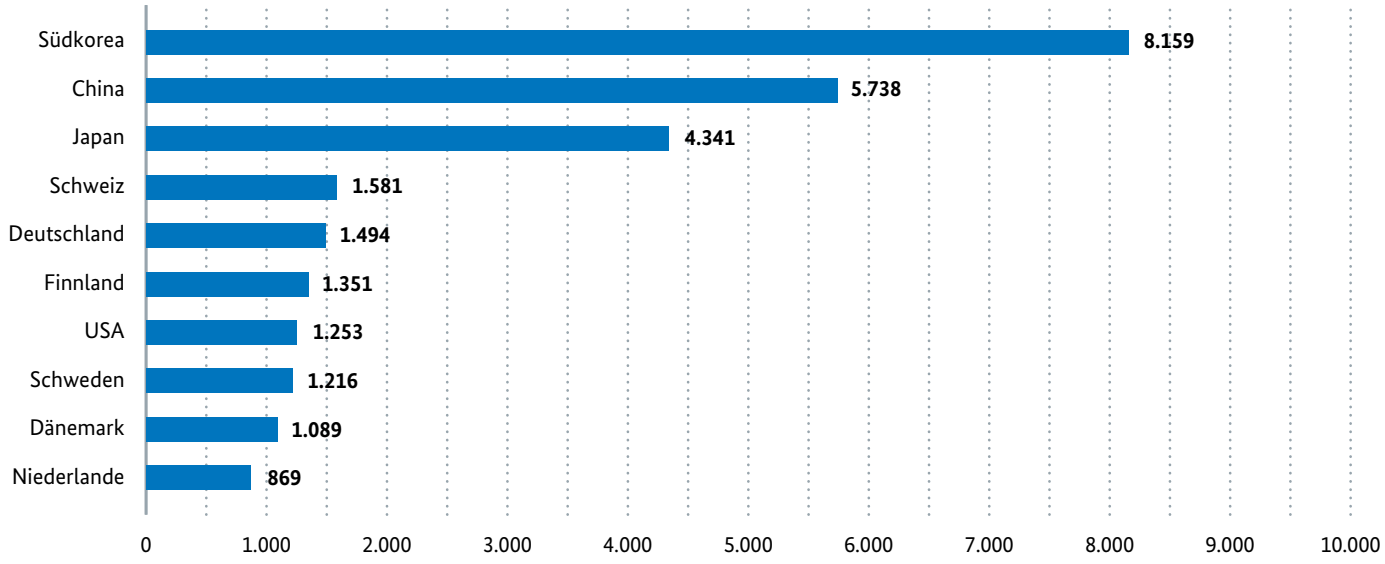
Nicht nur von ihrem Produktionsumfang ist die energieintensive Industrie ein wichtiger Grundpfeiler des verarbeitenden Gewerbes. Die genannten Industriezweige stehen meistens am Anfang komplexer Wertschöpfungsketten und sind als Zulieferer von Vorleistungsgütern zentral für andere Schlüsselindustrien in Deutschland und ganz Europa. Energieintensive Branchen stehen angesichts der aktuell – im internationalen Vergleich – hohen Energiekosten in Deutschland und mit Blick auf die Transformation zur Klimaneutralität vor besonders hohen Herausforderungen. Innerhalb dieser Branchen ist der Anteil von Energiekosten

am Produktionswert überdurchschnittlich hoch. Die energieintensiven Industriezweige hatten 2021 einen Anteil am gesamten Energieverbrauch der deutschen Industrie von rund 77 Prozent.

Zwei weitere Strukturmerkmale sind zentral für die deutsche Industrie. Erstens: lange integrierte Wertschöpfungsketten: Es werden nicht nur Endprodukte in Deutschland gefertigt, sondern auch Komponenten und Ausgangsmaterialien. Die räumliche Nähe begünstigt enge Kooperationen entlang der Wertschöpfungskette. Beispielsweise können Hersteller von Kunststoffen oder Metallen bei Bedarf die Eigenschaften ihrer Materialien durch Zusätze und Legierungen gezielt verändern – etwa die Festigkeit steigern, Gewicht reduzieren, die Haptik anpassen. Durch den engen Austausch mit ihren Grundstofflieferanten gewinnen Unternehmen Freiräume bei Design und Produktentwicklung. Die deutsche Industrie nutzt das für immer neue Innovationen. Durch Wertschöpfungsverflechtungen und breit verteilte Produktionsstufen über oft unterschiedliche Wirtschaftszweige hinweg sind zudem große Konzerne und kleine Unternehmen des Mittelstandes eng miteinander verknüpft. Sie stehen in einem wechselseitigen Verhältnis und arbeiten gemeinsam am gleichen Endprodukt.

Zweitens: eine starke Innovationstätigkeit. Der Anteil der Ausgaben für Forschung und Entwicklung (FuE) am Bruttoinlandsprodukt (BIP) lag in Deutschland im Jahr 2021 bei 3,13 Prozent. Mit einem Anteil von rund zwei Dritteln leisten die Unternehmen dazu den entscheidenden Beitrag. Besonders stark ist der FuE-Fußabdruck der Industrie, auf die rund 80 Prozent des Wirtschaftsanteils entfallen. Auch bei anderen Indikatoren im Bereich Forschung und Entwicklung zeigt sich, dass Deutschland und seine Industrie sich international in der Spitzengruppe wiederfinden und in diesem Sinne gut für die Herausforderungen der Zukunft gerüstet sind. Dies gilt etwa für Patentanmeldungen (s. Abb. 1).

Abbildung 1: Patentanmeldungen in Relation zum Bruttoinlandsprodukt, Top 10



Daten für das Jahr 2021. BIP-Daten in USD (Kaufkraftparitäten 2017). Top-10-Herkunftsländer berücksichtigt bei einem BIP größer als 25 Mrd. USD und mehr als 100 Patentanmeldungen von Einwohnern.

Quelle: World Intellectual Property Organization

Auch bei der Digitalisierung ist die deutsche Industrie vorne mit dabei. Jedes zweite Industrieunternehmen (48 Prozent) sieht die eigene Branche bei digitalen Innovationen im internationalen Vergleich sogar an der Spitze oder als Vorreiter. Bei der Industrie 4.0 ist Deutschland weltweit führend, Projekte wie Catena-X setzen globale Maßstäbe.

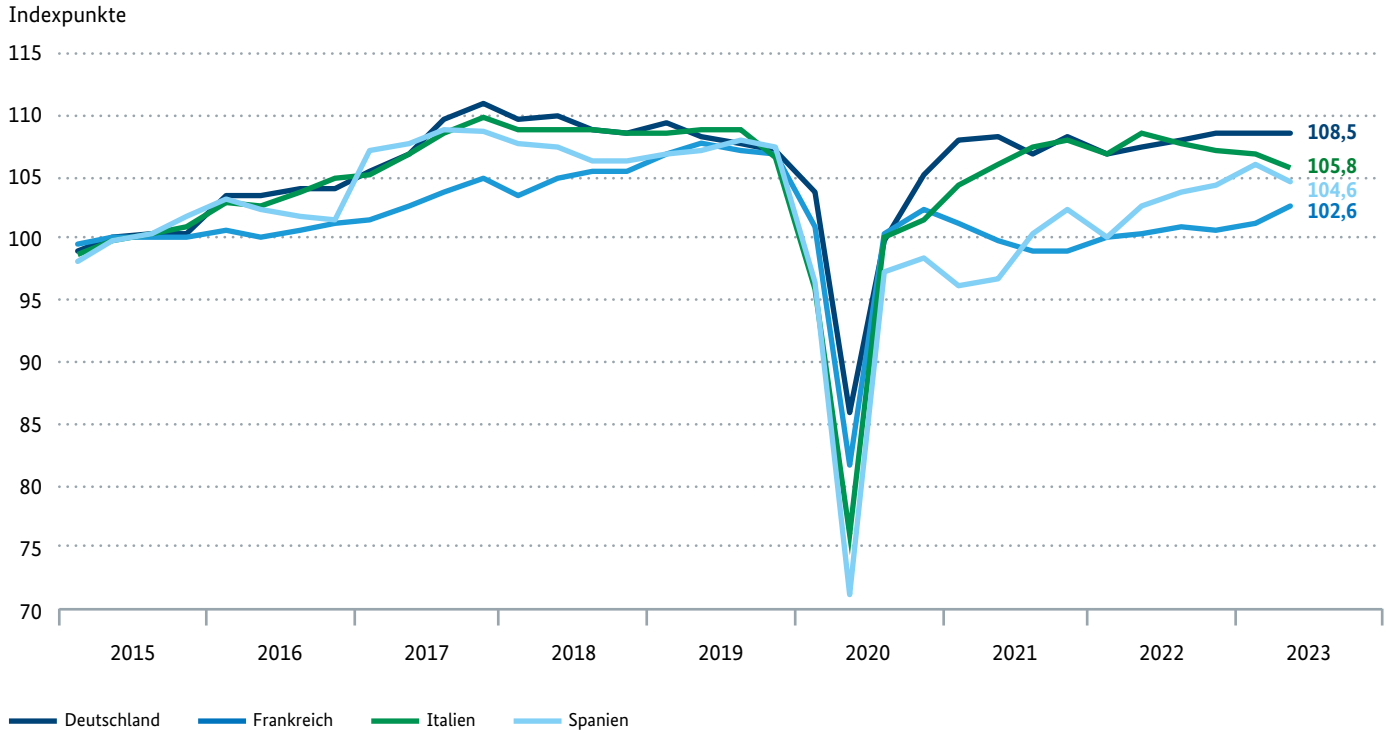
Und: Die deutsche Industrie ist nicht zu denken ohne ihre Arbeitnehmerinnen und Arbeitnehmer und die Kultur der Mitbestimmung und Sozialpartnerschaft. Der Erfolg des Industriestandorts beruht auf einem Wechselspiel zwischen praxisorientierter Ausbildung und institutionalisierter Mitbestimmung. Die duale Berufsausbildung und das Studium an universitären Hochschulen mit hoher Anwendungsorientierung bilden junge Menschen in enger Kooperation mit den Betrieben bedarfsgerecht zu Fachkräften aus. Institutionalisierte Mitbestimmung ermöglicht Beschäftigten, aktiv an Entscheidungsprozessen ihres Betriebes teilzuhaben. Dadurch steigt die Identifikation der Beschäftigten mit dem Betrieb und auch die Mitarbeitendenbindung. Dies begünstigt den Aufbau und die Vertiefung von betriebsbezogenem Wissen, welches durch die praxisorientierte Ausbildung an die kommende Generation weitergegeben wird.

2. Bedeutung der Industrie für Deutschland

Der Industriestandort Deutschland hat sich gerade wegen dieser vielfältigen Struktur trotz zahlreicher Krisen und Herausforderungen immer wieder als robust erwiesen – anders als von vielen vorausgesagt. Der Anteil des Verarbeitenden Gewerbes an der Bruttowertschöpfung liegt weiterhin bei gut einem Fünftel (2022: 20,4 Prozent). Dabei waren die Beschäftigten in der Industrie besonders produktiv: Pro Kopf erreichten sie eine um etwa 20 Prozent höhere Wertschöpfung als der gesamtwirtschaftliche Durchschnitt. Auf die energieintensive Industrie entfielen zuletzt rund 140 Mrd. Euro an Bruttowertschöpfung (und rund 14 Prozent der Beschäftigten in der Industrie), auf die nichtenergieintensive hingegen rund 700 Mrd. Euro.

Abbildung 2 zeigt die Entwicklung der industriellen Bruttowertschöpfung seit 2015. Deutlich erkennbar ist der Schock der Corona-Pandemie. Obwohl die Zeit seither durch Lieferengpässe, Fachkräftemangel und hohe Energiepreise gekennzeichnet war, erholte sich die deutsche Industrie schnell – und durchaus schneller als die Industrie anderer großer europäischer Volkswirtschaften.

Abbildung 2: Bruttowertschöpfung im Verarbeitenden Gewerbe



Index 2015 = 100, preis-, saison- und kalenderbereinigt

Quelle: Eurostat

Gleichwohl ist das aktuelle Umfeld für bestimmte Branchen sehr viel schwieriger als vor der Corona-Pandemie. Während die nicht-energieintensiven Industrien bemerkenswert resilient waren, ging die Produktion energieintensiver Branchen im Zuge der Verwerfungen an Energiemärkten infolge des russischen Angriffskriegs gegen die Ukraine spürbar zurück, ohne sich bisher zu erholen (s. Abb. 3 und 4).

Abbildung 3: Industrieproduktion

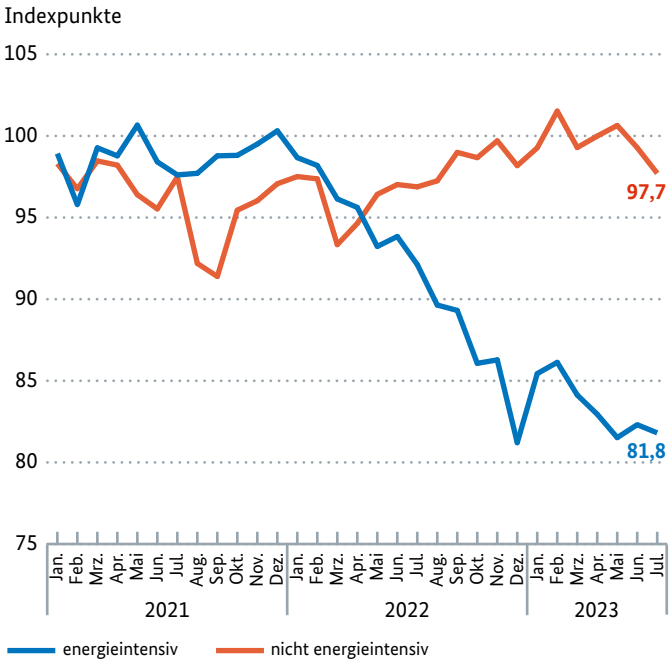
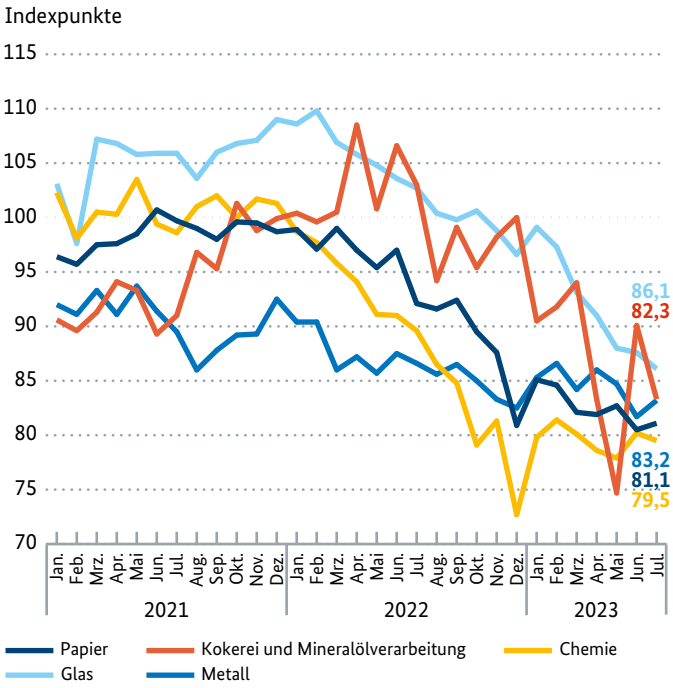


Abbildung 4: Produktion, energieintensive Branchen



Index 2015 = 100, preis-, saison- und kalenderbereinigt

Quelle: destatis

Die Industrie ist ein wichtiger Arbeitgeber mit rund 8 Mio. Beschäftigten in Deutschland. Hinzu kommen Millionen von Arbeitsplätzen in Unternehmen in den vor- und nachgelagerten Dienstleistungsbranchen, die von Aufträgen der Industrie profitieren und der Industrie wichtige Anwendungen liefern. Industrieunternehmen sind typischerweise attraktive Arbeitgeber, die gute Löhne zahlen und gute Beschäftigungsbedingungen bieten. So sind Angestellte in Industriebetrieben im Vergleich zur Gesamtwirtschaft deutlich seltener atypisch (in Teilzeit, geringfügig, befristet oder in Zeitarbeit) beschäftigt (13 Prozent gegenüber 21 Prozent in der Gesamtwirtschaft). Ferner werden sie überdurchschnittlich entlohnt: Der Median des Bruttoarbeitsentgelts in der Elektro-, Metall- und Stahlindustrie etwa lag zuletzt bei über 4300 Euro monatlich gegenüber rund 3600 Euro bei sozialversicherungspflichtig Vollzeitbeschäftigten insgesamt. Die guten Arbeitsbedingungen liegen insbesondere an der lang etablierten Sozialpartnerschaft zwischen Arbeitgeberverbänden und Gewerkschaften. Mitbestimmung ist in der Industrie deutlich weiter verbreitet als in der Gesamtwirtschaft. So arbeiteten 64 Prozent der Beschäftigten in Industriebetrieben ab fünf Beschäftigten in Betrieben mit einem Betriebsrat, in der Gesamtwirtschaft sind es nur 38 Prozent. Beschäftigte profitieren von der Mitbestimmung. Studien haben beispielsweise gezeigt, dass starke Mitbestimmung potenziell negativen Effekten der Automatisierung auf die Beschäftigung in der Industrie entgegenwirken kann und dass Unternehmen mit Mitbestimmung mehr in ihre eigene Zukunft investieren. Unternehmen bietet die Sozialpartnerschaft Stabilität und Planungssicherheit.

C. Herausforderungen des Industriestandortes

Bei allen Stärken steht das Industrieland Deutschland vor großen Herausforderungen.

Herausforderung: Geopolitische Zeitenwende

Wir erleben derzeit eine grundlegende Veränderung der internationalen Wirtschaftsordnung. Die letzten Jahrzehnte waren bestimmt von einer marktdominierten, aber zugleich regelgeprägten Globalisierung. Waren und Kapital sollten sich möglichst frei durch die Welt bewegen, Hürden wurden massiv abgebaut und starke Institutionen wie die WTO geschaffen, die verhindern sollten, dass neue Hürden entstehen. Diese Form der Globalisierung wurde wegen ihrer sozialen und ökologischen blinden Flecken zu Recht kritisiert, zugleich hat sie der Welt und Deutschland als Exportnation viel Wohlstand gebracht.

In den letzten Jahren sind jedoch geopolitische und geoökonomische Aspekte mit voller Wucht in die Wirtschaftspolitik zurückgekehrt. Dabei lassen sich insbesondere drei Entwicklungen nachzeichnen:

I. Das Bestreben, insbesondere Chinas, mittels einer strategischen Technologie- und Industriepolitik die eigene Machtposition im geoökonomischen Gefüge zu verbessern. China verfolgt eine Industriestrategie, die systematisch darauf abzielt, Technologieführerschaft zu erreichen und Wettbewerber aus dem Markt zu verdrängen. Ein typisches Beispiel für die chinesische Industriepolitik ist die Industriestrategie „Made in China 2025“. Sie identifiziert zehn strategisch relevante Technologiebereiche der Wirtschaft, in denen China bis 2025 eine internationale Spitzenstellung mit Dominanz auf heimischen und globalen Märkten einnehmen und über ein hohes Maß an wirtschaftlicher und technologischer Autarkie verfügen will. Hierzu werden insbesondere Zielgrößen für die heimischen Marktanteile chinesischer Unternehmen festgelegt und großzügige Subventionen bereitgestellt, die den Wettbewerb mitunter stark verzerren. Im Ergebnis zielt Made in China 2025 auf die Substitution ausländischer Anbieter auf dem chinesischen Markt ab. Dies wird ergänzt um das Bemühen, gezielt eigene globale Netzwerke und Abhängigkeiten zu schaffen („one belt, one road“). Diese Strategien sind nicht nur ökonomisch, sondern dezidiert auch außen- und sicherheitspolitisch gedacht.

II. Sie fallen zusammen mit einer stärker expansiven Ausrichtung autokratischer Regime und damit einhergehend einer Verschärfung der Konflikte mit dem Westen. Diese Realität ist mit dem russischen Angriffskrieg gegen die Ukraine als Zeitenwende über Deutschland hereingebrochen. In dieser neuen Realität erleben wir auch eine „weaponisation of trade“. Während im Kalten Krieg der Gasfluss nach Europa nie unterbrochen wurde, geschah genau dies im letzten Jahr. Auch deuten Äußerungen der chinesischen Führung (z. B. Präsident Xi 2020 vor Parteigremien) darauf hin, dass China anstrebt, wirtschaftliche und technologische Abhängigkeiten zu schaffen, um diese dann zur Durchsetzung politischer Ziele und Interessen zu nutzen.

III. Wir erleben – sowohl als Reaktion auf diese verschärfte geopolitische Konfliktlage als auch als Reaktion auf die innergesellschaftliche Spaltung – eine veränderte Wirtschaftspolitik unseres wichtigsten und engsten Partners, der USA. Zum einen betreiben die USA eine gezielte und konsequente Politik des De-Risking gegenüber China. Zum anderen stärken die USA sehr gezielt die eigene Industrie. Prägend im transatlantischen Zusammenspiel sind wei-

terhin eine grundlegende gemeinsame Werteorientierung und Partnerschaft sowie eine starke und nicht nur ökonomisch geprägte wechselseitige Verflechtung. Und der jüngst beschlossene US Inflation Reduction Act (IRA) ist dabei einerseits ein wichtiger Beitrag der USA zum Klimaschutz – einem gemeinsamen transatlantischen Ziel. Aber zugleich ist der IRA jedoch zusammen mit weiteren Impulsen wie dem CHIPS & Science Act und dem Infrastructure Investment and Jobs Act eine echte industriepolitische Herausforderung für Deutschland und die EU. Förderprogramme existieren zwar jenseits wie diesseits des Atlantiks. Mit den jüngsten, massiven Impulsen der US-Regierung drohen die Wettbewerbsbedingungen bei wichtigen Zukunftstechnologien aber eine Schieflage zu bekommen – zu Ungunsten Europas.

Deutschland hat – von der Politik über Verbände bis zu vielen Unternehmen – diese sich verändernde Realität lange nicht wahrnehmen wollen und nicht erkannt, welche Risiken daraus gerade für uns als Exportnation erwachsen. Stattdessen haben wir uns weiter der Vorstellung hingegeben, dass wirtschaftliche Verflechtung eine hinreichende Bedingung für das Ausbleiben geopolitischer Konflikte ist. Das hat sich als gefährliche und teure Fehlkalkulation erwiesen.

In Anbetracht der geopolitischen Realitäten müssen wir uns deshalb in Deutschland und der EU mit kritischen Abhängigkeiten in den Lieferketten auseinandersetzen. Die deutsche und die europäischen Volkswirtschaften insgesamt, aber auch einzelne Industriebranchen und -unternehmen sollten sich nicht in einseitige Abhängigkeiten bei Vorprodukten, Zukunftstechnologien oder von einzelnen Märkten begeben.

Beispielsweise stammen mehr als 80 Prozent der in Deutschland verkauften Laptops und über 90 Prozent der Photovoltaik-Anlagen aus China. Solche Abhängigkeiten werden oft nicht als Problem wahrgenommen, solange die Lieferkette funktioniert. Doch können bei einer Störung nicht kurzfristig alternative Lieferanten gefunden werden. Das wurde beispielsweise deutlich, als während der Corona-Pandemie ein anhaltender Lockdown der Hafenmetropole Shanghai auch in Deutschland die Produktion der Industrie behinderte, weil Vorprodukte fehlten.

Auch wenn viele mineralische Rohstoffe geologisch gesehen in hinreichender Menge vorhanden sind, folgt daraus nicht, dass entsprechende Rohstoffprodukte rechtzeitig in benötigten Mengen zur Verfügung stehen. Die aufwendigen Explorations-, Gewinnungs- und Aufbereitungsprozesse kritischer Rohstoffe, die eine kurzfristige Ausweitung des Angebots erschweren, tragen zur hohen Konzentration des Rohstoffmarkts bei. In vielen Fällen erfordert ihre Gewinnung lange Vorlaufzeiten und einen hohen Kapitalaufwand. Analysen der IEA legen nahe, dass zwischen der Aufsuchung kritischer Rohstoffe bis zur ersten Produktion durchschnittlich 16 Jahre vergehen. Für die Entwicklung und Inbetriebnahme der Rohstoffprojekte sind deshalb lange Zeitperspektiven nötig.

Herausforderung: Vernachlässigte Standortfaktoren

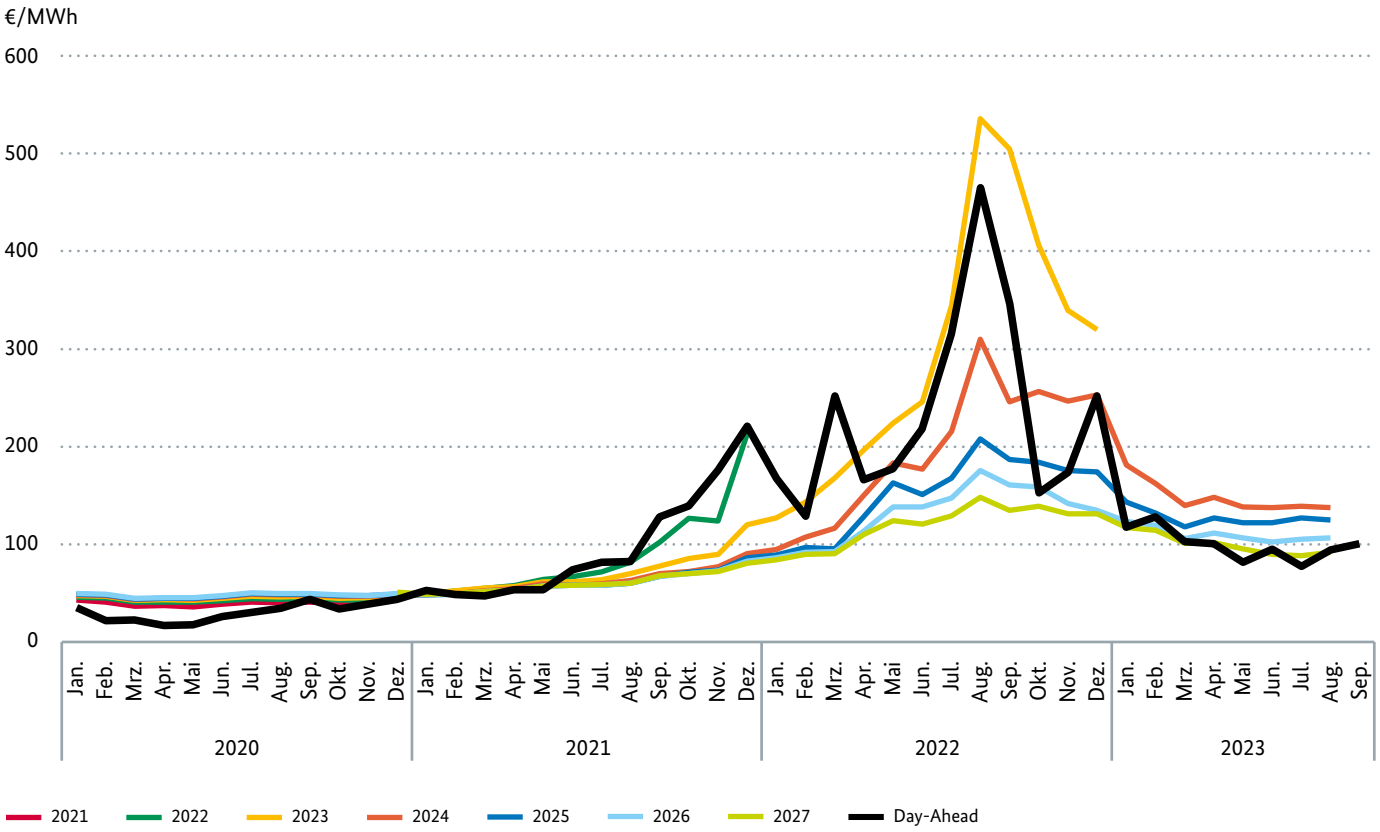
Es ist unübersehbar, dass sich trotz weiterhin vorhandener Stärken zentrale Standortfaktoren bereits über eine lange Zeit verschlechtert haben – auch durch ausgebliebene Reformen und strategische Fehler. Deutschland hat sich eine lange Phase der Selbstzufriedenheit erlaubt.

Energiepreise

Energie ist ein zentraler Produktionsfaktor – entsprechend wichtig sind ihre Verfügbarkeit und ihr Preis. Die Industrie verbrauchte 2021 rund 30 Prozent der gesamten Energie in Deutschland und 43 Prozent des gesamten elektrischen Stroms. Insbesondere energieintensive Unternehmen im internationalen Wettbewerb können Energiepreisanstiege nicht vollumfänglich auf ihre Abnehmer überwälzen. Entsprechend besteht das Risiko, dass sie mit Einschränkung oder Verlagerung von Investitionen oder Produktion reagieren.

Nach einer Phase längerer Stabilität sind im Umfeld des russischen Angriffskrieges gegen die Ukraine insbesondere die Gas- und Stromgroßhandelspreise stark gestiegen.

Abbildung 5: Stromgroßhandelspreise nach Lieferfristen



Jeweils Baseload.

Quelle: EEX, EPEX

Die starken Preisanstiege sind die Folge eines doppelten Fehlers der Energiepolitik der letzten zehn Jahre: der – trotz zahlreicher Warnungen – immer stärkeren Abhängigkeit von russischen Gasimporten und des mangelhaften Bemühens um einen schnelleren Ausbau Erneuerbarer Energien.

In der Folge sind auch die Preise für industrielle Abnehmer stark gestiegen. Unternehmen verschiedener Größe sind in unterschiedlichem Maße von diesem Anstieg betroffen gewesen. Bei kleineren Unternehmen, die ihren Strom über Energieversorger beziehen, sind die Preissteigerungen aufgrund längerfristiger Beschaffungsstrategien verzögert und gedämpft angekommen. Allerdings ist aufgrund dieser Beschaffungsstrategien auch zu erwarten, dass hier die Preisspitzen über einen längeren Zeitraum bemerkbar sein werden.

Abbildung 6: Gaspreis für Endverbraucher nach Abnahmemenge

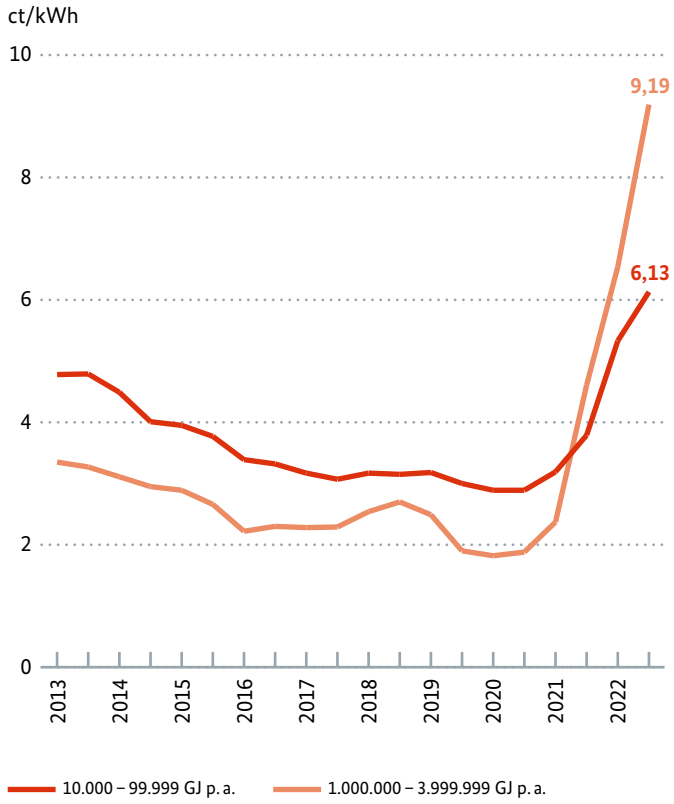
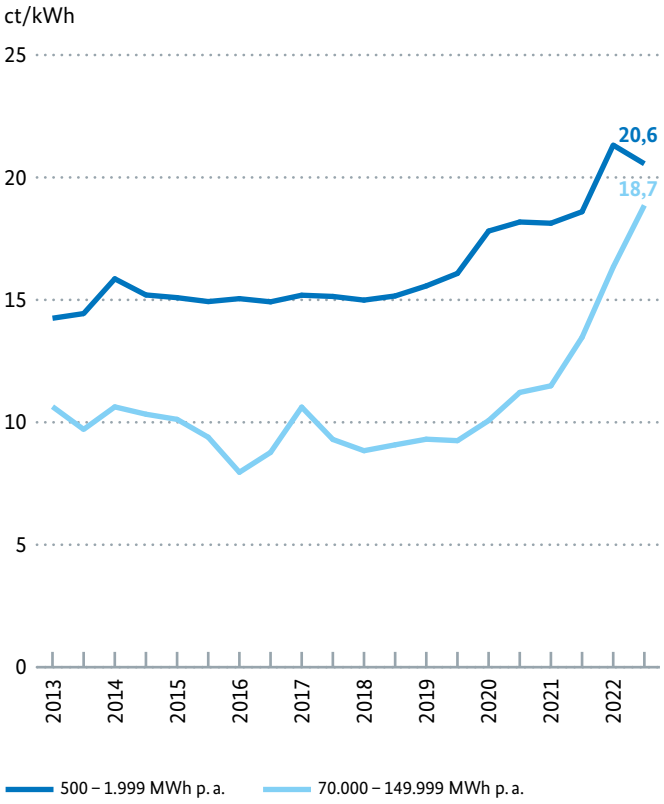


Abbildung 7: Strompreis für Endverbraucher nach Abnahmemenge



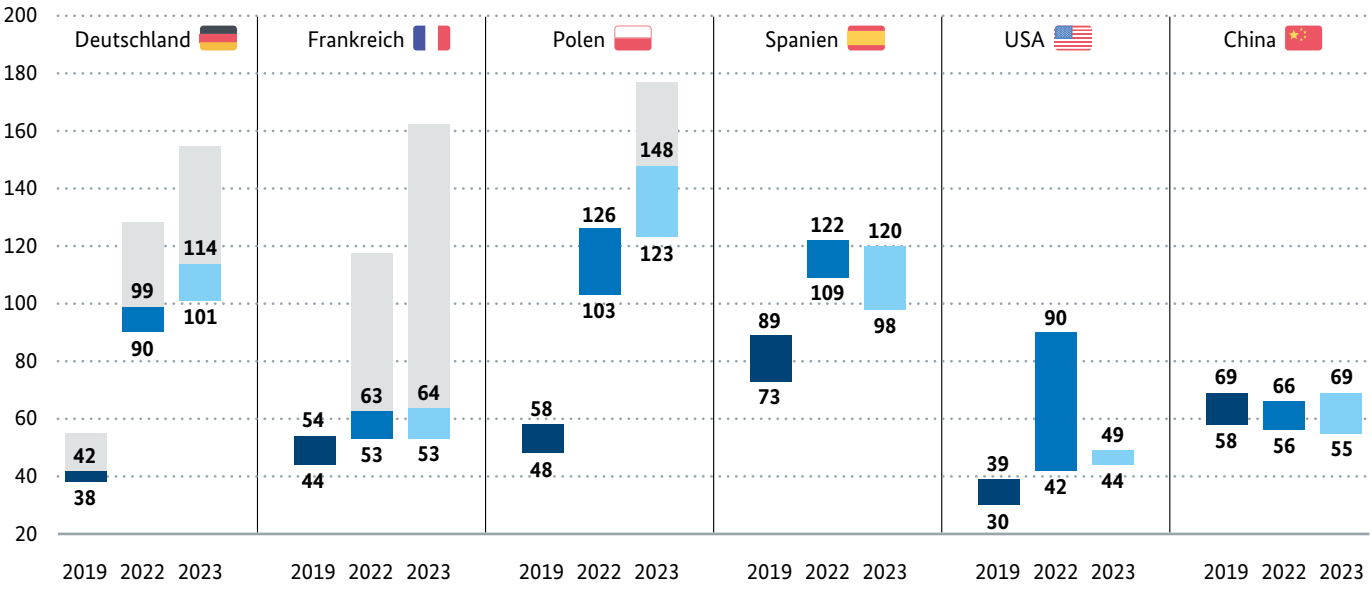
Durchschnittlicher Strom- und Gaspreis für Nicht-Haushaltskunden nach Abnahmemenge. Gesamtpreis inkl. Steuern, Abgaben und Umlagen, abzgl. abzugsfähige Steuern. Nominale Werte. Für vollprivilegierte Großverbraucher sind teils geringere Strompreise möglich.

Quelle: Eurostat

Für Großabnehmer, die ihren Strom selbst einkaufen oder erzeugen, war der relative Anstieg teils drastisch. In der Folge hat sich die Wettbewerbssituation für viele Industrieunternehmen und insbesondere für stromintensive Unternehmen gegenüber Unternehmen an anderen Standorten verschlechtert. Während die Strompreise für stromintensive Unternehmen beispielsweise der Chemie-, Stahl- und metallverarbeitenden Industrie vor dem Ukrainekrieg wettbewerbsfähig waren, zahlen diese Unternehmen oft inzwischen einen vielfach höheren Strompreis als Wettbewerber etwa in Frankreich, den USA oder China.

Abbildung 8: Strombezugskosten der Industrie, internationaler Vergleich

EUR/MWh, real 2022



Reduktion durch Entlastungsmechanismus

Die dargestellten Werte sind Preisspannen, die sich auf den tatsächlich gezahlten Strompreis inkl. aller Ausnahmeregelungen für ein großes Unternehmen der Chemie-, Stahl- und metallverarbeitenden Industrie mit konstantem Lastprofil beziehen. Die Preisspannen beinhalten sämtliche in den Märkten übliche anfallende Netzentgelte, Abgaben und Steuern (ausgenommen MwSt.). Den Berechnungen sind für die jeweiligen Länder marktübliche Beschaffungsstrategien zugrunde gelegt, für DEU, FRA und POL werden die Preisspannen aufgrund der jeweiligen Entlastungsmechanismen dargestellt. Strompreise der Industrie in den USA beinhalten Beschaffungspreise der Bundesstaaten Texas und Pennsylvania. Strompreise der Industrie in China beinhalten Beschaffungspreise der Provinzen Guangdong, Jiangsu und Shandong.

Zur Berechnung der Strombeschaffungskosten wurde für die EU eine Beschaffungsstrategie mit einem Mischpreis aus Spotmarktpreisen (30 Prozent) und Terminmarktpreisen (70 Prozent) angenommen. Für die USA und China wurden aufgrund der regionalen Besonderheiten Spotmarktpreise bzw. regulierte Preise (inkl. marktüblicher Rabatte) herangezogen. Entlastungsmechanismen für die Industrie in den jeweiligen Ländern wurden berücksichtigt: DEU: Strompreiskompensation, FRA: ARENH (90 Prozent), POL: Strompreisbremse.

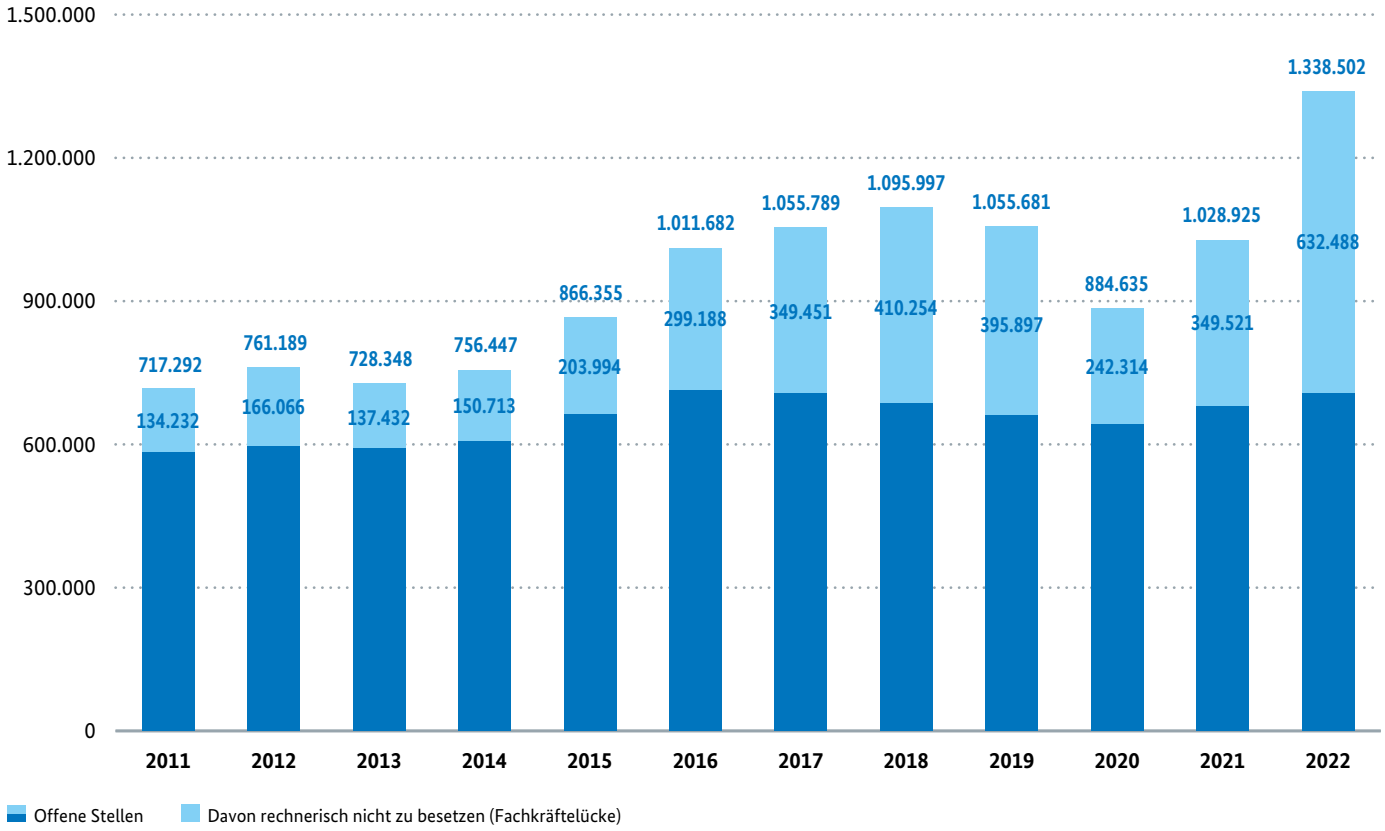
Quelle: AFRY

Zwar deuten Terminmarktnotierungen für die kommenden Jahre auf leicht sinkende Großhandelspreise hin, das Niveau vor der Krise wird jedoch nicht erreicht. Für zahlreiche Betriebe der energieintensiven Industrie sind diese Preise existenzbedrohend, es droht eine Erosion der deutschen Grundstoffindustrie und damit der Wegfall integrierter Wertschöpfungsketten.

Fachkräfte

Immer dringlicher wird der zunehmende Mangel an Arbeits- und Fachkräften: Unternehmen haben erhebliche Probleme, offene Stellen zu besetzen, und halten daher an ihren Fachkräften fest. So konnten 2022 im Jahresdurchschnitt mehr als 630.000 Stellen rein rechnerisch nicht mit passenden qualifizierten Arbeitslosen besetzt werden (s. Abb. 9). Die Verfügbarkeit gut ausgebildeter Fachkräfte ist für die Industrie von zentraler Bedeutung und hat traditionell zur Innovations- und Wettbewerbsfähigkeit des Produktionsstandort Deutschlands beigetragen. Es besteht allerdings die Gefahr, dass dieser Standortvorteil ohne weitreichende Maßnahmen verloren geht. Bereits jetzt zeigt die DIHK-Konjunkturumfrage vom Frühsommer 2023, dass 63 Prozent der befragten Industrieunternehmen im Fachkräftemangel ein Geschäftsrisiko für die nächsten zwölf Monate sehen.

Abbildung 9: Offene Stellen und Fachkräftelücke



Ohne Hilfstätigkeiten, gleitende Jahresdurchschnitte. Die Fachkräftelücke beschreibt die Anzahl offener Stellen, die rein rechnerisch nicht mit passend qualifizierten Arbeitslosen besetzt werden können.

Quelle: Kompetenzzentrum Fachkräftesicherung

Der Mangel an Arbeits- und Fachkräften wird sich aufgrund von zwei Entwicklungen deutlich verschärfen:

I. Der demographische Wandel führt zu einer Verknappung des Arbeitskräftepotenzials. In den kommenden Jahren wird die Zahl derer, die altersbedingt aus dem Erwerbsleben ausscheiden, deutlich wachsen. Gleichzeitig erreichen die Geburtsjahrgänge ab 2005 – nunmehr die geburtenschwächsten Kohorten – das Erwachsenenalter. Die damit verbundene Lücke ist erheblich: Der geburtenstärkste Jahrgang der heute 58/59-Jährigen erreicht im Jahr 2031 das 67. Lebensjahr und ist mit aktuell 1,4 Millionen Personen fast doppelt so groß wie die nachfolgenden Jahrgänge der heute unter 18-jährigen.

II. Die Digitalisierung und Dekarbonisierung der Wirtschaft führen zu massiven Verschiebungen in den nachgefragten Kompetenzen, sodass selbst qualifizierte Fachkräfte nicht zwangsläufig auch für neu gestaltete Arbeitsplätze qualifiziert sind.

An den entscheidenden Stellschrauben hat Deutschland zudem weiterhin Defizite. Die erheblichen Defizite im Bildungsbereich führen dazu, dass zu viele Menschen ohne Abschluss die Schule verlassen oder keinen Berufsabschluss erlangen. So haben 2021 rund 47.600 Jugendliche (6,2 Prozent der abgehenden Schülerinnen und Schüler) die Schule verlassen, ohne mindestens einen Hauptschulabschluss erlangt zu haben. Hinzu kommen rund 2,65 Mio. (17 Prozent) junge Menschen zwischen 20 und 35 Jahren, die keine abgeschlossene Berufsausbildung haben. Zudem arbeiten Frauen im europäischen Vergleich überdurchschnittlich häufig in Teilzeit. Insbesondere Mütter würden ihre Erwerbstätigkeit gerne ausweiten. Studien zeigen, dass rund 25 Prozent der befragten Mütter nicht erwerbstätig sind, obwohl nur 12 Prozent dies für sich wünschen. 21 Prozent der Mütter arbeiten weniger als 20 Stunden, aber nur 12 Prozent der Mütter möchten in diesem Umfang arbeiten. Wichtige inländische Talente und Potenziale kommen daher nicht zur Entfaltung und fehlen als qualifizierte Arbeitnehmerinnen und Arbeitnehmer. Auch sind die Hürden bei der Fach- und Arbeitskräfteeinwanderung in den deutschen Arbeitsmarkt insbesondere aus Drittstaaten weiterhin zu hoch.

Bürokratie, Planungs- und Genehmigungsprozesse

Die Qualität der Verwaltung in Deutschland ist im internationalen Vergleich grundsätzlich hoch. Die World Governance Indicators der Weltbank etwa bescheinigen Deutschland Spitzenwerte mit Blick auf Rechtsstaatlichkeit (z. B. Eigentumsrechte und Vertragsdurchsetzung), effektives Regierungshandeln (z. B. die Qualität öffentlicher Dienstleistungen und des öffentlichen Dienstes sowie die Glaubwürdigkeit von Politikmaßnahmen) und die Qualität von Regulierungen (Fähigkeit der Regierung, angemessene Maßnahmen und Regulierungen zu implementieren, die die Entwicklung des Privatsektors zulässt und fördert).

Dennoch gibt es Probleme: Lediglich 36 Prozent der Unternehmerinnen und Unternehmer schätzen die öffentliche Verwaltung in Deutschland als (sehr) leistungsfähig ein. Dabei sind sie insbesondere mit der Flexibilität sowie mit der Geschwindigkeit von Verwaltungsprozessen unzufrieden (jeweils 72 Prozent kaum, gar nicht oder weniger zufrieden). Im Bereich der immissionsschutzrechtlichen Genehmigungsverfahren etwa berichten rund die Hälfte der betroffenen Unternehmen von Problemen. Hier werden insbesondere ein zu großer Aufwand und eine zu lange Verfahrensdauer kritisiert. Der Blick auf die Länge der Genehmigungsverfahren offenbart ein gemisch-

tes Bild: Einerseits dauern nach Erhebungen des Bundesverbands der Deutschen Industrie immissionsschutzrechtliche Verfahren nach Vorliegen der Vollständigkeitserklärung im Schnitt sieben Monate, und damit nicht länger als gesetzlich für reguläre Verfahren vorgesehen. Andererseits trübt sich dieses Bild, wenn man die der Vollständigkeitserklärung vorgelagerten Schritte mitberücksichtigt. So dauern Verfahren von Einreichung der Unterlagen bis Erteilung des Bescheids im Schnitt elf Monate, stellt man auf den Projektbeginn ab, sogar 18 Monate.

Handlungsbedarf besteht auch in Sachen Digitalisierung: Zwar hat die digitale Transformation der deutschen Verwaltung seit der Einführung des Onlinezugangsgesetzes (OZG) 2017 Fortschritte gemacht. Es bestehen aber nach wie vor große Herausforderungen. Die EU-Kommission hat in ihrem Bericht zum Stand der Digitalen Dekade festgestellt, dass Deutschland insbesondere beim Angebot von öffentlichen Leistungen für Unternehmen unter dem EU-Durchschnitt liegt (Digital Decade Country Report Germany 2023). Es sind weiterhin zu wenige digitale Angebote bundesweit verfügbar, um die Wirtschaft zu entlasten.

Zudem lähmt immer mehr Bürokratie die Wirtschaft und mit ihr die Industrie. In der Regel werden dabei nicht einzelne gesetzliche Regelungen als Belastung wahrgenommen. Problematisch sind eher die Menge und insbesondere das komplexe Zusammenspiel der zahlreichen rechtlichen Vorgaben. Die Gründe liegen zum einen in der Vielzahl der gesetz- und verordnungsgebenden Ebenen von der EU über die Bundesregierung bis zu den Ländern und Kommunen. Zum anderen sind Gesetze notwendigerweise abstrakt formuliert. Das eröffnet beim Gesetzesvollzug Spielräume, die eine risikoaverse Verwaltung immer neue Gutachten fordern lässt. Ergebnis ist insgesamt ein mittlerweile investitions- und wachstumshemmendes Dickicht bürokratischer Regelungen. Das ist besonders für kleine und mittlere Unternehmen und den Mittelstand eine besondere Belastung, die für das Abarbeiten der bürokratischen Hürden nicht eigene Abteilungen unterhalten können. Trotz zahlreicher Bemühungen konnte dieses Dickicht bisher nicht wirksam eingedämmt werden: Der bürokratische Aufwand hat aus Sicht von 65 Prozent der Unternehmen seit 2015 deutlich zugenommen – trotz Einführung der Bürokratiebremse „one in, one out“ und von immerhin drei Bürokratieentlastungsgesetzen.

Infrastruktur

Die Wettbewerbsfähigkeit der deutschen Industrie hängt darüber hinaus maßgeblich ab von einer leistungsfähigen Infrastruktur – von intakten Straßen, Brücken und Schienen, schnellem Internet und einer zuverlässigen Stromversorgung bis hin zu guten Bildungsinstitutionen. Im internationalen Vergleich ist die Infrastruktur in Deutschland zwar relativ gut, für eine der reichsten Volkswirtschaften der Welt aber nicht gut genug. Standortrankings zeigen, dass Deutschland infrastrukturell traditionell gut aufgestellt ist, dieser Vorteil jedoch in jüngerer Vergangenheit in der Tendenz schwindet. So liegt Deutschland im World Competitiveness Ranking 2023 des IMD auf dem 14. Platz von 64 Ländern, eine spürbare Verschlechterung gegenüber dem Vorjahr (9. Platz).

Tatsächlich sind die staatlichen Bruttoanlageinvestitionen einschließlich derer für Infrastruktur seit Anfang der 90er Jahre gesunken. Auch wenn seit etwa 2017 ein spürbarer Anstieg zu verzeichnen ist: Im EU-Vergleich liegen die staatlichen Investitionen Deutschlands mit derzeit 2,6 Prozent des BIP (2022) deutlich unter dem Durchschnitt (3,2 Prozent). Aktuell liegt Deutschland in diesem Bereich im EU-Vergleich sogar auf dem drittletzten Platz. Die Bruttoanlageinvestitionen des Bun-

des bewegen sich dabei nach einem Tief nach der Finanzkrise (2014: rd. 0,6 Prozent) inzwischen auf stabil hohem Niveau (2022: 0,8 Prozent).

Besonders problematisch ist die Lage bereits seit Beginn des Jahrtausends auf kommunaler Ebene: Im Jahr 2022 betrugen die Nettoanlageinvestitionen der Kommunen -2,4 Mrd. Euro – der öffentliche Kapitalstock verfällt, und mit ihm die Qualität der für industriellen Erfolg notwendigen Infrastruktur. Laut einer Umfrage der KfW liegen die größten Investitionsrückstände der Kommunen bei den Schulen, gefolgt von Straßen und Verwaltungsgebäuden.

Auch auf Ebene des Bundes bleibt einiges zu tun. Zwar verfügt Deutschland über eines der bestausgebauten Verkehrsnetze in Europa. Aber es sind erhebliche Anstrengungen nötig, um die Bestandsinfrastruktur zu erhalten und zu modernisieren, insbesondere im Bereich der Schieneninfrastruktur, der Brücken und der Engpassbeseitigung.

Infrastrukturdefizite betreffen auch den digitalen Bereich. Während in Deutschland mittlerweile mehr als 90 Prozent aller Anschlüsse über Zugang zu einer Breitbandversorgung von mind. 100 Mbit/s verfügen, sind bisher nur 19 Prozent davon an das Glasfasernetz angebunden. Im Mobilfunk verfügt Deutschland mit 96 Prozent Flächenabdeckung von 4G-Netzen über eine bundesweite Versorgung mit grundlegenden mobilen Breitbandverbindungen. Der aktuelle Standard 5G, der deutlich effizienter und nachhaltiger als 4G ist, wird zurzeit jedoch nur in 89 Prozent der Fläche von Deutschland von mindestens einem Mobilfunknetzbetreiber angeboten. Zudem ist zu beachten, dass die Zahl zur Flächenabdeckung nichts über die konkrete Verbindungsqualität und -stärke aussagt, die gerade zum Rand der Netzfläche deutlich abnimmt.

Steuern und Abgaben

Die Steuer- und Abgabenpolitik spielt einerseits eine wichtige Rolle sowohl bei Investitionsentscheidungen von Unternehmen als auch für die internationale Wettbewerbsfähigkeit in Deutschland ansässiger Unternehmen. Steuereinnahmen und Abgaben sind andererseits entscheidend, um die öffentliche Infrastruktur, das staatliche Sicherungsnetz und die öffentlichen Dienstleistungen wie z. B. die Kinderbetreuung zu finanzieren.

Das deutsche Steuersystem ist komplex und kann für Unternehmen herausfordernd sein, auch aufgrund der föderalen Strukturen. Die Einhaltung der komplexen Vorschriften erfordert Ressourcen und hohen Zeitaufwand. Hier besteht weiterhin ein hohes Potenzial für Bürokratieabbau, insbesondere durch Vereinfachungsregelungen. Gleichzeitig ist die deutsche Steuerverwaltung sehr gut strukturiert. Der deutsche Steuerstandort bietet nach wie vor ein hohes Maß an Rechtssicherheit und Stabilität.

Hinsichtlich der Unternehmensbelastung eilt Deutschland der Ruf voraus, vergleichsweise hohe Steuern und Abgaben vorzusehen. Und in der Tat: Mit einer nominalen Steuerbelastung bei der Körperschaft- und Gewerbesteuer in Höhe von durchschnittlich ca. 30 Prozent belegt Deutschland im OECD-Vergleich einen der vorderen Plätze. Auch bei den effektiven Steuersätzen scheint Deutschland in den letzten Jahren an steuerlicher Wettbewerbsfähigkeit verloren zu haben. Das ist unter anderem auf einen weltweiten Trend zur Senkung der Unternehmenssteuern zurückzuführen, z. B. in den USA und Frankreich. Einzel- und Personenunternehmen unterliegen dagegen regelmäßig der progressiven Einkommensteuer. Des Weiteren ist die Belastung des Faktors Arbeit durch Steuern und Sozialversicherungsabgaben zwar seit dem Jahr 2000 trendmäßig gesunken, fällt aber ebenfalls weiterhin vergleichsweise hoch aus.

Herausforderung: Klimaneutrale Erneuerung

Die dritte zentrale Herausforderung ist die Erneuerung unseres Wohlstandes in Antwort auf die planetaren Grenzen, allen voran auf die Klimakrise. Mit rund einem Fünftel der in Deutschland ausgestoßenen Treibhausgasemissionen ist der Industriesektor dabei ein zentrales Handlungsfeld.

Die Transformation zur Klimaneutralität fordert die Industrie in mehrfacher Hinsicht umfassend heraus. Denn erstens verursacht die Herstellung von Industrieprodukten oft direkt Treibhausgasemissionen, die reduziert werden müssen. Zweitens bindet die Industrie jährlich mehr als 10 Millionen Tonnen an fossilem Erdöl in Chemieprodukten wie z. B. Kunststoffen, die nach Ende der Nutzung bei der Müllverbrennung zu CO_2-Emissionen führen. Und drittens stellt die deutsche Industrie im großen Umfang Produkte wie z. B. Verbrennungsmotoren her, die ihrerseits Emissionen verursachen. Die Märkte für solche Produkte werden umso schneller schrumpfen, je stärker sich die Weltgemeinschaft beim Klimaschutz engagiert und emissionsärmere Alternativen an Bedeutung gewinnen.

Deutschland hat sich zum Ziel gesetzt, 2045 klimaneutral zu sein, wie die EU und weltweit über 120 Staaten bis Mitte des Jahrhunderts auch. Uns bleiben also noch gut 20 Jahre, bis Deutschland treibhausgasneutral sein muss. Bis 2030 ist laut Bundes-Klimaschutzgesetz eine Emissionsreduktion im Industriesektor um rund ein Drittel gegenüber 2022 erforderlich, -57 Prozent gegenüber 1990. Um dieses Ziel einzuhalten, muss die bisherige Minderungsgeschwindigkeit gegenüber dem langjährigen Trend fast verdoppelt werden. Für die Transformation zur Klimaneutralität bleibt also nicht viel Zeit. Das gilt besonders vor dem Hintergrund üblicher Investitionszyklen und Nutzungsdauern für Industrieanlagen. In den kommenden beiden Dekaden muss bei vielen Herstellungsprozessen die Energiewende vollzogen werden. Das bedeutet den Umbau von Anlagen für die Nutzung klimafreundlicher Energieträger wie erneuerbaren Strom oder Wasserstoff. Für die stoffliche Nutzung von fossilem Kohlenstoff in Chemieprodukten braucht es Alternativen, z. B. eine Ausweitung der Recyclingwirtschaft oder die Abscheidung und Nutzung von CO_2. Schließlich muss die Industrie neue Märkte erschließen und Produkte ersetzen, die bislang mit der Emission von Treibhausgasen verbunden sind.

Die Transformation ist mit großen Chancen verbunden – auf eine Erneuerung unserer industriellen Basis und ihres Wohlstandes ohne Klima- und Umweltzerstörung, auf neue Produkte und Märkte, auf zukunftsfeste Arbeitsplätze. Zugleich geht sie mit erheblichen Anstrengungen und auch Unsicherheiten einher– für die Unternehmen wie für ihre Beschäftigten. Manche Unternehmen werden schrumpfen, neue Konkurrenzen entstehen, eingespielte Prozesse und Netzwerke geraten durcheinander. Arbeitsplätze werden sich verändern, in manchen Industrien werden es auch weniger werden.

Auf ihrem transformativen Weg ist die Industrie schon wichtige Schritte gegangen. Seit 1990 sind die Industrieemissionen um 41 Prozent gesunken. Gleichzeitig stieg die Bruttowertschöpfung des Verarbeitenden Gewerbes um etwa 80 Prozent. Das zeigt: Die Industrie kann auch künftig wachsen, sofern die Emissionsintensität hinreichend sinkt.

Im aktuellen Projektionsbericht erwartet die Bundesregierung für den Sektor Industrie bis 2030 eine Zielerreichungslücke. Diese Abschätzungen unterliegen hohen Unsicherheiten und bilden die aktuelle konjunkturelle Lage und insbesondere die stark verminderten Produktionsmengen in den energieintensiven Branchen nicht vollständig ab. Die weitere konsequente Umsetzung von

Klimaschutzmaßnahmen ist jedoch ohne Zweifel dringend erforderlich. Für die Transformation stehen die energieintensiven Industrien (u. a. Stahl, Zement und Chemie) besonders im Fokus, da sie eine verhältnismäßig hohe Emissionsintensität aufweisen.

Eine erhebliche Herausforderung bei der Transformation der Industrie zur Klimaneutralität liegt ferner im internationalen Wettbewerb. Weltweit verfolgen viele Staaten den Klimaschutz mit geringerer Ambition als Deutschland und die EU. In der Folge treffen hiesige Unternehmen auf dem Weltmarkt auf Wettbewerber, die keine oder nur geringe Kosten zur CO_2-Vermeidung zu tragen haben. Je höher die Handelsintensität in einem Sektor, desto größer das Risiko, dass sich die Produktion aus der EU in Staaten mit geringerer Klimaregulierung verlagert. Solches Carbon Leakage würde unserer Wirtschaft und dem Klima gleichermaßen schaden.

D. Die Kraft der Erneuerung – Industriepolitik in der Zeitenwende

1. Strategie einer Industriepolitik in der Zeitenwende

Auf die großen Herausforderungen, vor denen die soziale Marktwirtschaft und das Industrieland Deutschland stehen, braucht es eine strategische Antwort nicht nur der Unternehmen, sondern auch der Politik. Seit Amtsantritt hat die Bundesregierung zentrale industriepolitische Weichen gestellt, um den Industriestandort entlang der Ziele der Erneuerung des Wohlstands und der Stärkung der Wirtschaftssicherheit zu sichern. Damit ist ein Grundstein gelegt, nicht mehr, nicht weniger.

Es geht nun in den verbleibenden zwei Jahren der Legislaturperiode darum, den eingeschlagenen Weg fortzusetzen. Dabei ist klar: So wie sich die Herausforderungen über mehr als ein Jahrzehnt aufgebaut haben, wird auch ihre Beantwortung nicht im Rahmen einer Legislaturperiode möglich sein.

Aus Sicht des BMWK muss die Industriepolitik dabei konsequent von folgenden strategischen Ansätzen geleitet sein:

- Industriepolitik in der Zeitenwende ist notwendigerweise immer europäisch ausgerichtet.
- Industriepolitik in der Zeitenwende bedeutet in erster Linie eine Stärkung der Standortbedingungen.
- Industriepolitik in der Zeitenwende erfordert in vielen Fällen auch eine aktive Förderpolitik.

Starke Industrie in einem starken Europa

Der Rahmen für das industriepolitische Handeln in Deutschland ist immer und überall die Europäische Union. Der europäische Green Deal und die europäische Industriestrategie bieten dabei den strategischen Überbau. Eine Vielzahl von europäischen Instrumenten wie der EU Chips Act machen die von der Bundesregierung auf den Weg gebrachten Maßnahmen überhaupt erst möglich. Umgekehrt gilt auch: Der Erhalt des deutschen Industriestandorts ist ein wesentlicher Beitrag dazu, die industrielle Basis in Europa insgesamt zu sichern. Die deutsche Industrie liefert Vorprodukte und Bauteile für Industrieunternehmen von Finnland bis Portugal. Und die strategische Souveränität Europas hängt wesentlich davon ab, dass auch wir in Deutschland etwa für europäische Produktionskapazitäten für Halbleiter Sorge tragen und dafür auch unser finanzielles Gewicht auf die Waagschale bringen. Unsere Förderprogramme sollen nachhaltig hochwertige Wertschöpfung in Europa stärken.

Dabei gilt auch: Unsere Vorstellung von Wirtschaftssicherheit ist europäisch. Wenn es in Spanien, Slowenien oder Estland bereits ausreichende Produktionskapazitäten für ein kritisches Produkt gibt, dann müssen wir dies in Deutschland nicht mit staatlicher Unterstützung duplizieren. Und wenn etwa deutsche und französische Unternehmen gemeinsam in Nordfrankreich eine Batteriefabrik bauen, dann ist das nicht nur ein Ausdruck der engen Freundschaft zwischen unseren beiden Ländern, sondern auch ein enormer Beitrag zur Wirtschaftssicherheit Europas insgesamt. Wirtschaftssicherheit heißt, dass wir uns als EU nicht erpressbar und angreifbar machen – nicht, dass jeder Mitgliedstaat alles selbst herstellen kann. Letzteres bedeutete de facto die Aufkündigung des Binnenmarktes und wäre damit gerade für die deutsche Industrie ein fataler Fehler.

Es wäre dabei sinnvoll, die Industriepolitik stärker europäisch zu denken, auch um die Integrität des Binnenmarkts zu stärken. Allerdings fehlen dafür gegenwärtig sowohl die finanzielle Ausstattung als auch die Entscheidungsstrukturen und -fähigkeit zum Treffen strategischer Förderentscheidungen in

relevanten Größenordnungen. An diesen Voraussetzungen sollten wir arbeiten. Bis diese allerdings gegeben sind, sind starke nationale Industriepolitiken – eingebettet in die europäische Industriestrategie und entlang der europäischen Regeln – für den Wohlstand und die Wirtschaftssicherheit in Europa weiter unabdingbar.

Stärkung der Standortbedingungen

Unternehmen können hier nur erfolgreich sein und im internationalen Wettbewerb bestehen, wenn sie Bedingungen vorfinden, unter denen sie langfristig profitabel wirtschaften und auf die sie sich verlassen können. Den Wettbewerb um die Zukunft gewinnen wir nur durch offensive Stärke und durch eigene Wettbewerbsfähigkeit.

Deshalb verbessern wir die Bedingungen des Standorts mit einer entschiedenen transformativen Angebotspolitik. In einer Zeit, die durch ein sinkendes Angebot fossiler Energie, zunehmende Ressourcenknappheit und Fachkräftemangel geprägt ist, sollte der Staat mit einer solchen Politik den bestehenden Knappheiten entgegenwirken oder zumindest dafür sorgen, dass diese sich nicht weiter verschärfen. So kann auch mittelfristig der Inflationsdruck gedämpft werden, da staatliche Maßnahmen auf eine Ausweitung des Angebots (z. B durch Investitionen) und nicht auf eine Steigerung des Konsums ausgerichtet sind. Dabei haben wir folgende Schwerpunkte gesetzt:

- Ausweitung des Energieangebots in Form eines erheblich beschleunigten Ausbaus der Erneuerbaren Energien und der Netze. Aufbau einer Wasserstoffinfrastruktur und -industrie. Sicherstellung wettbewerbsfähiger Strompreise.

- Investitionsoffensive für die öffentliche Infrastruktur.

- Beschleunigung von Planungs- und Genehmigungsprozessen, Digitalisierung der Verwaltung, Entbürokratisierung.

- Gezielte Fachkräfteeinwanderung durch das Fachkräfteeinwanderungsgesetz sowie Verbesserung von Qualifizierungs- und Weiterbildungsangeboten.

- Gezielte steuerliche Anreize für Unternehmensinvestitionen.

In jedem dieser Felder hat die Bundesregierung bereits erhebliche Anstrengungen unternommen. Wichtige Schritte sind aber noch zu gehen – insbesondere bei der Energiewende, bei der Sicherstellung wettbewerbsfähiger Strompreise, bei der weiteren Planungsbeschleunigung und Entbürokratisierung und bei der konkreten Umsetzung der Fachkräfteeinwanderung. Die Verbesserung der Angebotsbedingungen müssen den Schwerpunkt der zweiten Halbzeit der Bundesregierung bilden.

Gezielte Unterstützung und Förderung im Brückenjahrzehnt

Teil unserer Industriepolitik ist in bestimmten, klar definierten Fällen auch die gezielte finanzielle Unterstützung und Förderung von Unternehmen und Branchen und damit eine aktive Rolle des Staates über das Setzen von Rahmenbedingungen hinaus. Damit sind wir nicht allein: Von den USA bis hin zu vielen unserer europäischen Partner nutzen Staaten diese Form von Industriepolitik.

Diese Form von Industriepolitik ist – nicht nur, aber besonders in Deutschland – politisch wie ökonomisch umstritten. Dafür gibt es auch gute Gründe. Industrieförderung impliziert notwendigerweise eine politische Auswahl, die sich zumindest zum Teil über Marktmechanismen hinwegsetzt, anfällig für Lobbyismus ist und deren Erfolg

nicht garantiert ist. Außerdem bindet sie Ressourcen, die auch anderswo eingesetzt werden können.

Diese Einwände lassen sich über die kluge Ausgestaltung von Förderinstrumenten abmildern, aber selten ganz entkräften. Deshalb bedarf eine breit angelegte und großvolumige Förderung, wie wir sie als Teil unserer Industriepolitik nutzen, einer besonderen Begründung – gerade im Rahmen dieser Industriestrategie.

Zunächst einmal werden in der Wirtschaftswissenschaft eine ganze Reihe von Fällen beschrieben, in denen eine aktive staatliche Förderpolitik aus sich heraus gerechtfertigt ist, weil es zu Marktversagen kommt. In diesen Fällen kann es etwa sinnvoll sein, mit staatlicher Förderung Innovationen zur Marktgängigkeit zu verhelfen oder das Hochskalieren von Produktion zu unterstützen. Für bestimmte Zukunftstechnologien ist es im besten Sinne gute Wirtschaftspolitik, wenn wir hier in Deutschland den Innovationsprozess bis hin zur Marktreife vorantreiben und damit offensiv darauf setzen, Technologieführerschaft in einem zentralen Feld zu übernehmen.

Doch über diese allgemeine ökonomische Begründung für eine aktive Förderpolitik hinaus gibt es im spezifischen deutschen Kontext gute Gründe, warum ein gezieltes finanzielles Engagement des Staates Teil unseres industriepolitischen Instrumentenkastens in der Zeitenwende ist:

- Deutschland und Europa müssen auf die veränderte geopolitische Lage insbesondere in Folge des russischen Angriffskrieges gegen die Ukraine und im Angesicht des immer aggressiveren Auftretens Chinas reagieren. Ein Weiter-so wäre gefährlich für die Sicherheit Deutschlands und Europas und für unser wirtschaftliches Wohlergehen. **Wirtschaftssicherheit ist deshalb eine neue Priorität unserer Industrie- und Wirtschaftspolitik.** Das bedeutet zunächst, unsere Rohstoffbeziehungen, Lieferketten und Absatzmärkte zu diversifizieren. Gefährliche Abhängigkeiten müssen abgebaut, die Handelsbeziehungen insgesamt diversifiziert und mit Verbündeten intensiviert werden. Das bedeutet aber auch, dass wir strategisch wichtige Industrien in Europa halten, verloren gegangene zurückholen und neue Schlüsselindustrien ansiedeln. Autarkie wäre ein völlig falsches Ziel und kontraproduktiv, auch weil sie die Widerstandskraft unserer Volkswirtschaft gegen inländische Schocks erheblich verringern würde – notwendig ist aber, dass wir im Netzwerk mit unseren engsten Verbündeten und insbesondere innerhalb der EU über Kompetenzen und Produktionskapazitäten verfügen, die bei Bedarf hochskaliert werden können. Dafür werden wir einfach umsetzbare Resilienzkriterien in öffentlichen Ausschreibungen stärker einsetzen und darauf achten, dass bei öffentlichen Förderungen die europäische Wertschöpfungskette gestärkt wird. Doch wir werden für den Aufbau von Produktionskapazitäten auch direkte Förderung vorsehen müssen. Das kostet zwangsläufig Geld. Wirtschaftssicherheit hat ihren Preis – so wie es die klassische Sicherheitspolitik auch hat. Diesen Preis müssen wir aber in einer solidarischen Anstrengung, je nach Kräften und Möglichkeiten, zahlen, wenn wir unsere Sicherheitsinteressen und die unserer Bündnispartner respektieren wollen. Hinzu kommt: Auf eine Stärkung der Wirtschaftssicherheit zu verzichten, würde uns noch viel teurer zu stehen kommen. Das machte uns verletzlicher, abhängiger und im Krisenfall kostet es die Volkswirtschaft enorm viel. Das haben wir schmerzlich durch den russischen Angriffskrieg auf die Ukraine und die Folgen für die Energieversorgung und Energiepreise zu spüren bekommen. Auch die Unterbrechung der Lieferketten während der Pandemie und die daraus folgenden enormen

Kosten für die Weltwirtschaft sind hierfür ein Indiz.

- In der Klimapolitik wird häufig mit Recht darauf verwiesen, dass die beste – weil effiziente – Lösung in einem globalen CO_2-Preis liege. Viele Argumente über Sinn und Unsinn finanzieller Förderung zur Erreichung von Klimazielen leiten sich aus diesem First-Best-Szenario ab. Ein globaler CO_2-Preis ist aber derzeit genauso unrealistisch wie die Gründung eines großen Klimaclubs mit einheitlichem CO_2-Preis: In den USA ist eine CO_2-Bepreisung auf absehbare Zeit nicht durchsetzbar. Mit dem IRA setzen sie im Rahmen einer strategischen Industriepolitik stattdessen auf massive Subventionen und Steuererleichterungen. Auch China hat nur einen sehr niedrigen CO_2-Preis, sehr wohl aber eine massive Förder- und Subventionspolitik für Transformationstechnologien wie E-Autos, Wind und Solar. Auf diese Realität der klimapolitischen Second-Best-Lösungen und auf das daraus resultierende Wettbewerbsumfeld müssen wir in der Europäischen Union und in Deutschland reagieren. Denn in einem solchen Umfeld führt ein rein marktgetriebener Ansatz über Emissionshandelssysteme zu schwerwiegenden Wettbewerbsnachteilen. Wir müssen also unsere **Industrie vor unfairem Wettbewerb schützen** und ihr die **Umstellung auf klimafreundliche Produktionstechnologien** ermöglichen – einerseits über Ausgleichsinstrumente wie den CO_2-Grenzausgleichsmechanismus CBAM oder handelspolitische Schutzmaßnahmen der EU, andererseits aber eben auch, indem auch wir zentrale Klimaschutztechnologien fördern. Dabei versuchen wir möglichst marktnah vorzugehen, indem wir beispielsweise im Fall der Klimaschutzverträge auf ein Auktionssystem und damit auf den Wettbewerb der Unternehmen um die kostengünstigste Emissionsvermeidung bauen.

- In Deutschland gestalten wir endlich entschlossen und aktiv den Übergang zur Klimaneutralität und damit den Wechsel zu den Erneuerbaren Energien. Wir haben uns in den letzten Jahrzehnten auf Strom aus weitgehend abgeschriebenen fossilen Kraftwerken und auf die Verfügbarkeit von billigem Erdgas verlassen und davon profitiert. Dabei sind aber die notwendigen Zukunftsinvestitionen ausgeblieben. Nun investieren wir in die grundlegende Erneuerung unseres Energiesystems. Diese Anstrengung wird sich auszahlen: Das Energieangebot, das so entsteht, bietet wettbewerbsfähige Preise, Versorgungssicherheit und Klimaneutralität. Wir erleben allerdings gerade in Deutschland vor allem deshalb eine Phase des harten Übergangs, weil im letzten Jahr zusätzlich zu den Versäumnissen beim EE-Ausbau auch die Brücke billigen russischen Gases weggebrochen ist. Diese Übergangsphase bis Anfang der 30er Jahre bringt hohe Anpassungs- und Investitionskosten und große Unsicherheit mit sich. Diese **Übergangsphase zu glätten,** um Unternehmen, die hier dauerhaft wettbewerbsfähig produzieren können, zu halten, ist ökonomisch wie politisch gut begründet. Ökonomisch, weil es Kosten hat, Wertschöpfungsketten aufgrund eines temporären Phänomens zu zerstören und sie hinterher wiederaufzubauen. Politisch, weil gerade konzentrierte Produktions- und damit Arbeitsplatzverluste in bestimmten Sektoren und Regionen zu einer Gefahr für den sozialen Zusammenhalt werden können. Dabei ist klar: Es haben auf Dauer nur Unternehmen eine Chance, die mit den langfristigen Kosten des neuen Energiesystems in Deutschland werden arbeiten können. Deutschland war nie der Standort mit den niedrigsten Energiepreisen und wird dies schon aufgrund seiner geographischen Lage auch in Zukunft nicht sein.

Die Förderung von Industrieunternehmen, die oft jahrzehntelang hohe Gewinne eingefahren haben, ist kein Selbstzweck, sondern sie muss gesellschaftlichen Zielen wie der Sicherung von guter Arbeit und Wohlstandsteilhabe, dem Klimaschutz oder der Wirtschaftssicherheit unseres Landes dienen. Deshalb muss die Förderung auch an Beiträge zu diesen Zielen gebunden sein. Wir setzen deshalb zum Beispiel auf Garantien für den Erhalt von Standorten und machen – wo möglich – die Bindung an Tarifverträge zur Bedingung unserer Förderung.

Bei der Gestaltung der Förderprogramme leiten uns zudem verschiedene Grundsätze: Kredite, Bürgschaften oder rückzahlbare Zuschüsse sollen, wenn möglich, Vorrang vor nicht-rückzahlbaren Subventionen haben. Das Fördersystem soll kohärent sein und einer wissenschaftlichen Erfolgskontrolle unterzogen werden. Jede Förderung braucht eine Exit-Strategie, damit ungewollte Dauersubventionen vermieden werden. Zudem werden wir darauf achten, dass der Zugang zu unseren Förderprogrammen erleichtert und die Antragsstellung und Abwicklung entbürokratisiert wird. Schließlich wollen wir unsere Fördermechanismen klug weiterentwickeln, so dass haushaltspolitische Spielräume bestmöglich ausgenutzt und im Erfolgsfall auch Rückzahlungen möglich werden. Die Klimaschutzverträge sind ein wichtiger Schritt in diese Richtung.

Außerdem wollen wir mit unseren engsten Verbündeten auf engere Absprachen im Hinblick auf die Gewährung von finanzieller Förderung hinarbeiten und damit teure Subventionswettläufe möglichst eindämmen.

Mit den vielen oft großvolumigen Förderprogrammen hat die Bundesregierung gemeinsam wichtige Entscheidungen getroffen. Diese müssen aber fortgesetzt und durchgehalten werden – und das ruft Finanzierungsfragen auf. Der Klima- und Transformationsfonds (KTF) hat sich zum zentralen Finanzierungsinstrument für Investitionen in die Erneuerung unserer Industrie entwickelt. Mit den Ende 2021 dafür zusätzlich eingestellten kreditfinanzierten Mitteln gibt es dafür eine gute Basis. Allerdings passt der KTF aufgrund seiner derzeitigen Finanzierungsstruktur – seine Einnahmen speisen sich alleine aus dem EU-Emissionshandel und den Einnahmen über das deutsche BEHG – nicht zum mittel- und langfristigen Förderhorizont und -volumen vieler industriepolitischer Vorhaben, die wir nun gemeinsam begonnen haben.

Das gilt umso mehr, als dass mit einem steigenden CO_2-Preis insbesondere für Gebäude und Verkehr auch die Finanzierung von sozialen Abfederungsmaßnahmen im Klimaschutz stärker in den Blick rücken muss und so das für industriepolitische Vorhaben verfügbare Volumen schmaler wird. Deshalb steht spätestens mit Beginn der nächsten Legislaturperiode eine Richtungsentscheidung an, wie die notwendige strategische Industriepolitik zur Sicherung des Standorts, zur Erneuerung unseres Wohlstands und zur Stärkung unserer Wirtschaftssicherheit auf finanziell nachhaltig belastbare Füße gestellt werden kann. Unsere Finanzverfassung ist in Zeiten entstanden, die noch von einer marktdominierten Globalisierung und von deutlich weniger geopolitischen Spannungen geprägt waren. Wir müssen als Land diskutieren, wie diese Regeln an die neuen Realitäten angepasst werden können. Denn die Kosten der notwendigen Erneuerung unseres Wohlstands und der Stärkung unserer Wirtschaftssicherheit müssen solidarisch gestemmt werden – als Entlastung derer, die sie nur so tragen können. In dieser Versöhnung von Anstrengung und Solidarität, von Leistung und Anerkennung, liegt die Zukunftskraft unseres Landes.

2. Maßnahmen einer Industriepolitik in der Zeitenwende

Entlang dieser strategischen Ansätze hat die Bundesregierung seit ihrem Amtsantritt entschlossene industriepolitische Schritte unternommen, die für die nächsten Jahre weiter auf der Agenda stehen müssen. Konkret übersetzen sie sich in drei wesentliche Handlungsfelder:

- **Stärken, was uns wettbewerbsfähig macht:** Wir haben eine Reihe von horizontalen Maßnahmen zur Sicherung und Stärkung der Wettbewerbsfähigkeit des Industriestandorts ergriffen und weitere werden folgen – von der Energieversorgung über die Digitalisierung bis zur Fachkräfteeinwanderung.

- **Aufbauen, was uns sichert:** Zur Stärkung unserer Wirtschaftssicherheit diversifizieren wir unsere Handelsbeziehungen, investieren in neue, eigene Produktionskapazitäten etwa für Halbleiter und Transformationstechnologien und sichern durch Diversifizierung und den Ausbau der Kreislaufwirtschaft den Zugang zu Rohstoffen langfristig. Dafür ergreifen wir entschiedene Maßnahmen.

- **Erneuern, was uns stark macht:** Die Transformation zur Klimaneutralität macht es notwendig, dass wir die industrielle Basis, die uns bisher stark gemacht hat, erneuern. Dafür haben wir in Deutschland und Europa einen klaren Ordnungsrahmen durch Emissionshandel und Regulierung gesetzt sowie umfassende Förderprogramme aufgelegt.

Diese drei Handlungsfelder werden im Folgenden ausgeführt.

2.1 Stärken, was uns wettbewerbsfähig macht

Die Bundesregierung hat die Aufgabe der Standortstärkung seit ihrem Amtsantritt angenommen und in einer Vielzahl von Bereichen Maßnahmen ergriffen, um die Standortbedingungen in Deutschland zu verbessern. Viele dieser Maßnahmen werden in den nächsten Jahren ihre Wirkung immer stärker entfalten. Doch bleiben trotzdem in wichtigen Bereichen, vor allem im Bereich der Energiepreise und der Beschleunigung, noch entscheidende Fragen offen, auf die wir zügig eine Antwort finden müssen.

a) Energieversorgung sichern und Energiepreise wettbewerbsfähig machen

Die verlässliche Versorgung mit Energie zu wettbewerbsfähigen Preisen ist eine entscheidende Bedingung für die langfristige Sicherung des Industriestandorts. Dies gilt im besonderen Maße für die energieintensiven Unternehmen, die das Rückgrat der deutschen Industrie bilden und die Vorprodukte für die Produktion in vielen anderen Sektoren herstellen. Das gilt aber auch für die Breite der deutschen Industrie vom Kleinbetrieb über den Mittelständler bis zum Großkonzern: Nur wenn wir dauerhaft die Energieversorgung zu wettbewerbsfähigen Preisen sichern, hat der Industriestandort insgesamt eine gute Zukunft.

Energiewende

Zentraler Baustein hierfür ist das Gelingen der Energiewende: In Zukunft wird die Industrie auf Basis von Erneuerbaren Energien versorgt werden, vor allem durch erneuerbaren Strom, Wasserstoff sowie klimaneutrale Kohlenwasserstoffe. Erneuerbare Energien sind nicht nur die richtige Antwort auf die Klimakrise, sie stärken auch nachhaltig Preisstabilität und Versorgungssicherheit für die Industrie.

Im Zentrum der Energiewende steht der Ausbau der erneuerbaren Stromerzeugung, vor allem von Wind- und Solarenergie. Seit Beginn der Legislaturperiode haben wir mit den Novellen des Erneuerbare-Energie-Gesetzes (EEG) und des Windenergie-auf-See-Gesetzes sowie mit der Windenergie-an-Land-Strategie und der PV-Strategie die Bremsen gelöst. Und das zeigt Wirkung: Der Ausbau zieht deutlich an, der PV-Ausbau boomt wieder. Auch bei Wind geht es schon jetzt sichtbar voran, der volle Umfang des Aufschwungs wird sich bedingt durch die länger dauernden Genehmigungsverfahren aber erst in den nächsten Jahren zeigen. Darüber hinaus erarbeiten wir eine Kraftwerksstrategie, um die Transformation des Kraftwerkparks in Richtung Wasserstoff zu unterstützen. Damit schaffen wir bereits kurzfristig Planungssicherheit für Investitionen in neue Gas- bzw. Wasserstoffkraftwerke, die zukünftig die erneuerbare Stromerzeugung aus Wind- und Solarenergie flankieren werden.

Eine wesentliche Voraussetzung für die Versorgung von Energieverbrauchern und der deutschen Industrie ist der Ausbau unserer Energieinfrastruktur. Durch den Ausbau der Stromnetze wird zukünftig beispielsweise Windstrom aus dem Norden Deutschlands und aus der Nord- und Ostsee in die industriellen Verbrauchszentren transportiert. Hierfür haben wir zahlreiche Maßnahmen zur Beschleunigung des Stromnetzausbaus ergriffen. Im neuen Netzentwicklungsplan Strom wird zudem erstmals ein Klimaneutralitätsnetz bis 2045 entwickelt. Damit die Infrastrukturplanung zukünftig die zunehmenden sektorübergreifenden Wechselwirkungen innerhalb des Energiesystems berücksichtigt, erarbeiten wir zudem die Systementwicklungsstrategie, die unter anderem die Kohärenz zwischen den Netzentwicklungsplänen für Strom und Gas bzw. Wasserstoff gewährleisten soll.

Neben erneuerbarem Strom ist die Versorgung mit Wasserstoff und Wasserstoffderivaten die zweite große Säule der Energieversorgung der Zukunft. Mit der Fortschreibung der Nationalen Wasserstoffstrategie werden die Voraussetzungen geschaffen, dass bis 2030 mindestens 10 GW heimische Elektrolyseleistung zur Verfügung stehen. Zusätzlich ist der Import von Wasserstoff und Wasserstoffderivaten in großem Umfang nötig. Um den Importhochlauf zu organisieren, werden durch H2Global bereits jetzt Investitionen zum zügigen Aufbau von Wasserstoffproduktionsanlagen und Lieferketten organisiert. Die Nationale Wasserstoffstrategie wird außerdem um eine Importstrategie ergänzt, damit notwendige Investitionsentscheidungen in die Wasserstoffproduktion im Ausland sowie in die notwendigen Lieferketten frühzeitig getroffen werden können. Um dies sicherzustellen, haben wir schon eine Reihe von Abkommen mit anderen Staaten abgeschlossen.

Um den Wasserstoff von den Erzeugungsstandorten und Importpunkten zu den industriellen Verbrauchern zu transportieren, erarbeiten wir derzeit ein Konzept für den Aufbau einer Wasserstoffinfrastruktur. Damit frühzeitig ein erstes Kernnetz zur Anbindung zentraler Wasserstoffstandorte entsteht, wird noch in diesem Jahr das Energiewirtschaftsgesetz (EnWG) novelliert. Der entsprechende Gesetzentwurf der Bundesregierung wurde am 24. Mai 2023 im Kabinett beschlossen. Zudem soll zeitnah im EnWG die gesetzliche Grundlage für einen integrierten Netzentwicklungsplan Gas und Wasserstoff geschaffen werden, damit über das Kernnetz hinaus weitere Wasserstofferzeuger, -verbraucher und -speicher angeschlossen werden können. Mit einem Wasserstoffbeschleunigungsgesetz werden wir die regulatorischen und gesetzgeberischen Rahmenbedingungen vereinfachen.

Zentral ist zudem die Erhöhung der Energieeffizienz und der Flexibilität des Stromeinsatzes. Beides sind zentrale Stellschrauben für einen wettbewerbsfähigen Industriestandort, der vor allem durch Erneuerbare Energien versorgt wird. Energieeffizienz hilft enorm bei der großen Aufgabe der Transformation. Hier hat die Bundesregierung durch das Energieeffizienzgesetz erstmals einen gesetzlichen Rahmen gesetzt.

Flexibilität ist notwendig, weil es in den kommenden Jahren immer mehr Stunden geben wird, in denen Strom gratis oder sogar zu negativen Preisen zu beziehen ist. Die bessere Digitalisierung des Stromsystems und die Vermarktung von Flexibilitätspotenzialen bei Industrieprozessen und Wärmeerzeugung können dazu beitragen, Schwankungen des besonders günstigen Angebots an Wind- und Solarstrom auszugleichen und die Stromkosten zu senken.

Wettbewerbsfähige Energiepreise

Durch den russischen Angriffskrieg auf die Ukraine sind die Preise für praktisch alle Energieträger massiv gestiegen. Der zügige Ausbau der erneuerbaren Energieversorgung und der dafür erforderlichen Infrastruktur ist zentral für die Zukunft des Industriestandorts, denn er ist die Voraussetzung dafür, dass die Strompreise langfristig und nachhaltig wieder sinken können. Mit dem fortschreitenden Ausbau wird wieder ein wettbewerbsfähiges Niveau erreicht werden. Mit dem vom BMWK vorgestellten Konzept für einen langfristigen Transformationsstrompreis haben wir einen Weg aufgezeigt, wie wir für die im internationalen Wettbewerb stehende stromintensive Industrie besonders schnell die steigenden Anteile günstiger, erneuerbarer Stromerzeugung für mehr Planungssicherheit bei den Strompreisen mobilisieren können.

Wir müssen uns aber darauf einstellen, dass der Börsenstrompreis bis zum Ende der Dekade erhöht bleibt. Deshalb müssen wir handeln. Bereits direkt nach dem russischen Angriff und dem Ausbleiben der Gaslieferungen aus Russland hat die Bundesregierung gemeinsam mit der Industrie den Aufbau einer neuen Import-Infrastruktur für Flüssiggas in bisher ungekanntem Deutschlandtempo auf den Weg gebracht. Mit den Gas- und Strompreisbremsen haben wir zügig die Energieverbraucher und damit auch die deutsche Industrie gegen hohe Preisspitzen abgesichert, Unternehmen entlastet und Planungssicherheit geschaffen. So hat die Bundesregierung das Land gemeinsam mit Unternehmen und Verbraucherinnen und Verbrauchern gut durch den Winter gebracht und eine akute Gasmangellage verhindert.

Durch die Übernahme der EEG-Finanzierung in den KTF entlasten wir zudem alle Stromverbraucher nach aktueller Prognose um rund 50 Mrd. Euro in den nächsten vier Jahren. Davon profitieren ganz besonders kleine und mittlere Unternehmen.

Zudem hat die Bundesregierung es Unternehmen erheblich erleichtert, selbst zu handeln, um sich kostengünstig mit Strom zu versorgen. Selbsterzeugter grüner Strom ist seit diesem Jahr von allen Abgaben befreit, wenn er in den eigenen Betriebsstätten erzeugt und verwendet wird. Das kann gerade für den Mittelstand eine praktikable Lösung sein, den Bezugspreis deutlich reduzieren.

Dies gilt jedoch nicht für die energieintensive Industrie im internationalen Wettbewerb. Sie hat deutlich höhere Kostensteigerungen zu verkraften, profitiert kaum von der Abschaffung der EEG-Umlage und kann die erhöhten Stromkosten wegen der hohen Wettbewerbsintensität besonders schlecht weitergeben. Deshalb wird gerade die

energieintensive Industrie in den nächsten Jahren weitere Unterstützung benötigen, um mit den Folgen des Krieges umgehen zu können. Um für die Übergangszeit bis zu sinkenden Preisen durch den fortschreitenden Ausbau der Erneuerbaren die industrielle Wettbewerbsfähigkeit zu sichern und insbesondere die Grundstoffindustrien intakt zu erhalten, ist der vom BMWK vorgeschlagene Brückenstrompreis das entscheidende Instrument. Andernfalls drohen Produktionsrückgänge oder sogar die Abwanderung strukturell wettbewerbsfähiger Unternehmen aus Deutschland, insbesondere in den Grundstoffindustrien. Damit würden Ausgangspunkte von Wertschöpfungsketten zerstört, die sich durch ganz Europa ziehen. Dies nicht zuzulassen, ist nicht nur im deutschen, sondern im gesamteuropäischen wirtschaftlichen wie sicherheitspolitischen Interesse. Der Brückenstrompreis sollte um die Fortführung des Spitzenausgleichs bei der Stromsteuer ergänzt werden.

b) Infrastrukturen modernisieren

Die Bundesregierung hat eine Reihe konkreter Maßnahmen beschlossen, um die „vererbten" Investitionsrückstände im Infrastrukturbereich zu überwinden. Um Investitionen weiter zu fördern, hat die Bundesregierung zusätzliche Mittel für Investitionsausgaben eingeplant: Im Regierungsentwurf für den Haushalt des Jahres 2024 sind dafür 54,2 Mrd. Euro vorgesehen sowie in der Finanzplanung von 2024 bis 2027 insgesamt rd. 23,2 Mrd. Euro zusätzlich.

Mit dem Koalitionsbeschluss vom 28.3.2023 wurde vereinbart, bis zu 45 Milliarden Euro in den Jahren 2023 – 2027 für das Schienennetz bereitzustellen, u. a. durch den Einsatz von anteiligen Einnahmen aus dem CO_2-Zuschlag der LKW-Maut. Außerdem sind zusätzlich zu den rund 11,5 Milliarden Euro aus dem Kernhaushalt weitere 12,5 Milliarden Euro über den KTF bis 2027 für Investitionen bei der Deutschen Bahn vorgesehen. Mit diesem Geld soll unter anderem das Schienennetz saniert und weiter ausgebaut werden.

Aber nicht nur fehlende finanzielle Mittel, sondern auch lange Planungs- und Genehmigungsverfahren standen in der Vergangenheit der Modernisierung der Infrastruktur im Weg. Mit dem Gesetz zur Beschleunigung von Verfahren im Verkehrsbereich sollen nun Genehmigungsverfahren für Verkehrsinfrastrukturprojekte verkürzt und Investitionen schneller, effizienter und zielsicher umgesetzt werden. Beispielsweise soll durch die Feststellung eines überragenden öffentlichen Interesses für ausgewählte Projekte sowie einfachere Regeln beim Artenschutz das Schienennetz deutlich schneller ausgebaut werden. Aber auch für besonders wichtige Straßenausbauvorhaben, insbesondere bei Engpässen, gilt in Zukunft das überragende öffentliche Interesse – denn auch ein funktionsfähiges Straßennetz ist ein entscheidender Standortfaktor für die deutsche Industrie und gerade für kleinere und mittlere Betriebe.

Auch bei der digitalen Infrastruktur setzt sich die Bundesregierung für einen zukunftssicheren Ausbau und die Nutzung aktuellster Standards ein. Mit der Umsetzung der Gigabitstrategie werden wir bis 2025 50 Prozent und bis 2030 100 Prozent aller Haushalte und Unternehmen an das Glasfasernetz anschließen. Dies erreichen wir, indem wir u. a. die Planungs- und Genehmigungsverfahren digitalisieren und beschleunigen, alternative Verlegetechniken einsetzen und enger mit den Ländern, Kommunen und Marktteilnehmern zusammenarbeiten. Auch den Mobilfunkausbau unterstützt die Bundesregierung aktiv, indem sie die Verbreitung von 5G-Netzen fördert, z. B. mit der „5G-Umsetzungsförderung". Gleichzeitig bereiten wir uns mit Projekten wie INTERSOUL und 6G-CampuSens auf den zukünftigen Standard 6G vor.

c) Deutschland entkrusten und Genehmigungen beschleunigen

In Deutschland ist über die Jahrzehnte ein regelrechtes Bürokratie-Dickicht entstanden, das nur noch schwer zu durchdringen ist. Mittlerweile ist dies ein echtes Investitionshemmnis, gerade für den Mittelstand. Die Verwaltung in Deutschland soll den Unternehmen als Partner zur Seite stehen. Verfahren sollen beschleunigt, Bürokratie abgebaut werden – in Deutschland wie in der EU insgesamt.

Die Bundesregierung hat bereits eine Reihe von erheblichen Beschleunigungsmaßnahmen ergriffen, insbesondere im Bereich des Infrastrukturausbaus und der Erneuerbaren Energien. Wichtig für den Industriestandort ist, dass auch für die Industrie selbst Genehmigungsprozesse erheblich beschleunigt werden. Im Rahmen der von der Bundesregierung beschlossenen BImSchG-Novelle werden erste Verfahrenserleichterungen angestrebt, wie die Stärkung der Rolle des Projektmanagers, eine Beschränkung der Verlängerungsmöglichkeiten für Genehmigungsfristen und die Vereinfachung einer digitalen Antragstellung.

Hierbei dürfen wir es aber nicht belassen. Um die für die Transformation unserer Wirtschaft erforderlichen Beschleunigungen auf den Weg zu bringen, müssen alle staatlichen Ebenen mitwirken. Daher erarbeitet die Bundesregierung unter Führung des Bundeskanzlers gemeinsam mit den Ländern einen Deutschlandpakt für weitere konkrete Beschleunigungsmaßnahmen. Daneben werden wir dort auch die Erhöhung der personellen und technischen Kapazitäten der Genehmigungsbehörden auf Bundes-, Landes- und kommunaler Ebene adressieren.

Der rechtliche Rahmen für Planungs- und Genehmigungsverfahren ist zu einem erheblichen Teil europarechtlich geprägt. Daher setzen wir uns auch im Zuge europäischer Rechtsakte für schnellere Genehmigungsverfahren ein. Mit dem Net Zero Industry Act (NZIA) und dem Critical Raw Materials Act (CRMA) müssen maßgeschneiderte Beschleunigungsimpulse für zentrale Transformationssektoren gesetzt werden. Die Bundesregierung setzt sich dabei mit Nachdruck dafür ein, dass auch die Umstellung von Produktionsprozessen auf klimafreundlichere Verfahren von den im NZIA vorgesehenen Erleichterungen erfasst wird.

Auch beim Bürokratieabbau hat die Bundesregierung nicht nur entschiedene gesetzgeberische Schritte auf den Weg gebracht, sondern bedient sich auch einer neuen Methode: Das BMWK hat mit den „Praxis-Checks“ ein Verfahren entwickelt, bei dem im Zusammenspiel von Gesetzgebung, Vollzug und Unternehmen Hemmnisse und Lösungsansätze für einzelne Fallkonstellationen und Investitionsvorhaben identifiziert werden. Nach dem Praxis-Check „Errichtung und Betrieb von PV-Anlagen“ sollen nun weitere Praxis-Checks folgen, z. B. zur Genehmigung von Windenergieanlagen an Land, zur Nachhaltigkeitsberichterstattung sowie zu Unternehmensgründungen. Zusätzlich wird die Bundesregierung noch in diesem Jahr den Entwurf für ein neues Bürokratieentlastungsgesetz vorlegen, in das alle Ressorts Abbauvorschläge einbringen müssen.

Um selbst voranzugehen, hat das BMWK eine umfassende, systematische Überprüfung aller in seiner Zuständigkeit liegenden Informationspflichten auf Aktualität, Harmonisierungsmöglichkeiten, unnötige Schriftformerfordernisse und sonstige Ansatzpunkte zur Entlastung für der Wirtschaft angestoßen.

Auch bürokratische Belastungen, die auf EU-rechtliche Vorgaben zurückgehen, müssen auf den Prüfstand. Deshalb hat das BMWK eine Konsultation zu bürokratischen Hemmnissen auf

EU-Ebene im Bereich der ökologischen Transformation durchgeführt, deren Ergebnisse an die Europäische Kommission weitergegeben wurden. Darüber hinaus möchte die Bundesregierung gemeinsam mit Frankreich eine europäische Bürokratieentlastungsinitiative starten. Außerdem setzt sich die Bundesregierung auf europäischer Ebene für die Schaffung eines einheitlichen europäischen Portals für arbeitsrechtliche Entsendemeldungen ein. Über dieses Portal sollen zukünftig Entsendemeldungen (eDeclaration) und perspektivisch auch die Beantragung von A1-Bescheinigungen erledigt werden.

d) Innovationen und Spitzentechnologie fördern

Deutschland ist ein starker Standort für Forschung und Entwicklung (FuE) – und unsere starke Forschungslandschaft ist ein entscheidender Standortvorteil für unsere Industrie. Innovationen sind zentraler Faktor für die Fortsetzung der Erfolgsgeschichte der deutschen Industrie und Grundlage für die technologische und digitale Souveränität. Unser Innovationsmotor ist die Vielfalt der Unternehmen vom kleinen Weltmarktführer bis zum Großkonzern und ihre Einbettung in eine breit aufgestellte und ebenso vielfältige Forschungslandschaft. Dazu gehört neben Hochschulen auch eine starke außeruniversitäre Forschung, welche das Spektrum von der Grundlagenforschung (Max-Planck-Gesellschaft, Leibnitz-Gemeinschaft) bis hin zur angewandten Forschung (Helmholtz Gemeinschaft Deutscher Forschungszentren, Fraunhofer Gesellschaft) abdeckt.

Die deutsche Industrie erfindet sich immer wieder neu und prägt mit ihren Innovationen die internationalen Märkte. Gleichzeitig ist die Innovationsführerschaft keine Selbstverständlichkeit und liegt nicht allein in der Hand der Unternehmen. Es braucht die richtigen Rahmenbedingungen, Unterstützung und Beinfreiheit für Innovationen, damit die deutsche Industrie ihre Stärke weiterhin ausspielen kann. Die Transformation zur Klimaneutralität und massive staatliche FuE-Investitionen globaler Wettbewerber erhöhen den ohnehin bestehenden Innovationsdruck zusätzlich.

Die Technologie- und Innovationspolitik der Bundesregierung muss die Vielfalt der deutschen Industrie abbilden und Lösungen für die Anforderungen der Unternehmen und industrienahen Forschung anbieten. Wir setzen dabei auf verschiedene Instrumente von der themen- und branchenoffenen Innovationsförderung bis zur gezielten Unterstützung einzelner Schlüsseltechnologien.

Wichtiger Adressat der technologieoffenen Innovationsförderung ist der Mittelstand. Das BWMK bietet eine breite Palette an Förderprogrammen wie z. B. die Industrielle Gemeinschaftsforschung (IGF) und das Zentrale Innovationsprogramm Mittelstand (ZIM). Mit dem IGF werden vorwettbewerbliche Forschungsvorhaben gefördert, so dass insbesondere KMU Zugang zu praxisorientierter Forschung erhalten. Das Zentrale Innovationsprogramm Mittelstand (ZIM) unterstützt mit Hilfe von Zuschüssen branchen- und themenoffen marktorientierte technische Forschungs- und Entwicklungsprojekte von Mittelständlern und mit ihnen kooperierenden Forschungseinrichtungen (inkl. Hochschulen) sowie das Netzwerkmanagement von Innovationsnetzwerken. Ziel ist, die Innovationskraft des Mittelstandes zu stärken. Mit der Unterstützung von Start-ups und Existenzgründungen bringen wir zusätzliche Dynamik in die industrielle Innovation und verbreitern die Grundlage für neue industrielle Technologieführer. Die Start-up-Strategie der Bundesregierung bündelt 130 Maßnahmen für ein starkes Start-up-Ökosystem in Deutschland und setzt einen ambitionierten Zeitplan bis zum Ende der Legislatur. Insbesondere wird das gut entwickelte System der Frühphasenfinanzierung von Start-ups durch großvolumige

Finanzierungsangebote im Bereich der Wachstumsfinanzierung ausgebaut. Die Module des Zukunftsfonds mit einem Volumen von 10 Mrd. EUR und einer Mobilisierungswirkung von 30 Mrd. EUR einschließlich der Mittel privater Investorinnen und Investoren bis 2023 werden maßgeblich zur Entwicklung neuer Wachstumsunternehmen beitragen. Auch von der Stärkung der steuerlichen Forschungsförderung profitiert insbesondere der Mittelstand.

Gleichzeitig geht die Bundesregierung neue Wege. Sprunginnovationen können einen existierenden Markt grundlegend verändern oder einen komplett neuen Markt erschaffen. Die Bundesagentur für Sprunginnovationen (SPRIND) arbeitet daran, dass aus hochinnovativen Ideen aus Wirtschaft, Wissenschaft und Forschung erfolgreiche Produkte, Dienstleistungen und Arbeitsplätze in Deutschland und Europa entstehen. Im Rahmen des SPRIND-Freiheitsgesetzes werden der SPRIND nun endlich die richtigen Instrumente für ihre Arbeit zur Verfügung gestellt. Reallabore wiederum bringen neue Technologien und innovative Lösungen, die allgemein noch nicht zugelassen sind, schnell und sicher in die Anwendung. Mit einem Reallabore-Gesetz werden wir neue Freiräume zur Erprobung von Innovationen schaffen. Erfolgreiche Beispiele – etwa für autonome Busse, Schiffe oder Drohnen, Telemedizin oder nachhaltige Quartierslösungen – zeigen, dass neue Lösungen und Technologien in Reallaboren deutlich schneller und gleichzeitig sicher in die Anwendung gelangen können. Gleichzeitig stärken sie die Akzeptanz für Innovationen und sie ermöglichen zu lernen, wie Innovationen nach der Erprobung rechtlich geregelt werden sollten, damit am Ende alle von ihnen profitieren.

Technische Standards begleiten Innovationen in den Markt. Die deutsche Industrie spielt eine wichtige Rolle in der internationalen Normung und Standardisierung. Das unterstützen wir als Bundesregierung unter anderem mit der Normungsförderung und dem neugegründeten Deutschen Strategieforum für Standardisierung.

Deutschland und Europa müssen auch in Zukunft die Technologieführerschaft in zentralen Schlüsseltechnologien behaupten und neu erwerben. Die Bundesregierung geht dabei gemeinsam mit europäischen Partnerinnen und Partnern und der Wirtschaft voran. Insbesondere mit den „Important Projects of Common European Interest (IPCEI)“ werden im europäischen Verbund gemeinsame Prioritäten gesetzt, Ressourcen gebündelt und private Investitionen unterstützt. Dabei werden hoch innovative Projekte von mehreren Mitgliedstaaten gemeinsam gefördert, die einen großen Spillover-Effekt auf den Binnenmarkt insgesamt haben können. Deutschland beteiligt sich an den IPCEIs in den Bereichen Mikroelektronik, Batteriezellfertigung, Cloud-Infrastruktur und Wasserstoff.

Auch die pharmazeutische Industrie ist eine starke Treiberin der Innovation. Während der Corona-Pandemie wurde das sehr deutlich, als Unternehmen aus Deutschland wesentlichen Anteil an der Bereitstellung von lebensrettenden Arzneimitteln hatten. Daraus ergaben sich für den Standort erhebliche Wertschöpfungszuwächse. Zugleich wurden während der Pandemie auch Abhängigkeiten und Lieferengpässe sichtbar. Wir wollen die Attraktivität des Pharmastandorts Deutschlands erhöhen und ausbauen. Deshalb setzt sich die Bundesregierung dafür ein, dass die Rahmenbedingungen für eine starke, nachhaltige und international wettbewerbsfähige Pharmaindustrie verbessert werden. Dazu wollen wir Vorschläge zur Weiterentwicklung des EU-Vergaberechts für kritische Arzneimittel entwickeln und prüfen mittels eines Gutachtens zu Bedarfen im Bereich der Wagniskapitalfinanzierung, ob und wo die bestehenden und bereits geplanten branchenoffenen Angebote zur Wachstumsfinan-

zierung auch für Branchen wie z. B. Medizin und Bioökonomie verbessert werden können.

Quantentechnologien sind ein weiterer Pfeiler für die technische Weiterentwicklung insbesondere in den Bereichen Sensorik, Kommunikation und Kryptografie, der Simulation von quantenmechanischen Systemen sowie in der Rechentechnik. Mit der institutionellen Förderung der Quantencomputing-Initiative des Deutschen Zentrums für Luft- und Raumfahrt (DLR) implementieren wir eine zentrale Säule des Handlungskonzepts Quantentechnologien der Bundesregierung. Die Initiative ist so ausgestaltet, dass sie direkt zur Etablierung eines unternehmerischen Ökosystems Quantencomputing in Deutschland beiträgt. Der Bund sichert zugleich nachhaltig die technologische Souveränität über die Entwicklungen und verankert die Innovationstreiber stärker in Deutschland und Europa.

Darüber hinaus unterstützen wir die Industrie in zahlreichen weiteren Initiativen. So engagiert sich die Bundesregierung nachdrücklich, um Robotik als deutsche Kernkompetenz weiter voranzubringen. Unser Ziel ist es, menschliche Arbeitskräfte zu entlasten und die Robotik als attraktives Instrument zur Realisierung von ökonomischen und ökologischen Effizienzgewinnen zu etablieren – auch bei kleinen und mittelständischen Unternehmen. Ebenso setzen wir unser Engagement für die Raumfahrt fort. Diese agiert oftmals an der Grenze des technisch Machbaren. Das fördert Innovationen in den verschiedensten Bereichen wie zum Beispiel in der Mikroelektronik oder der Materialwissenschaft. Aber auch die Anwendungen von weltraumbasierten Daten und Dienstleistungen auf der Erde haben großes Innovationspotenzial. Die neue Raumfahrtstrategie der Bundesregierung bildet dabei die Grundlage für eine innovative und nachhaltige Raumfahrt.

Ein weiteres wichtiges Innovationsfeld ist der Leichtbau. Durch die Entwicklung immer neuer Lösungen für Gewichts- und Materialeinsparungen und für funktionale Mehrwerte bringt der Leichtbau kontinuierlich Innovationen als einen wichtigen Beitrag zur Transformation der Industrie hervor. Mit der Umsetzung der in diesem Jahr vom Bundeskabinett beschlossenen Leichtbaustrategie soll ein entscheidender Beitrag zur Reduzierung der Treibhausgasemissionen sowie zur Entkopplung von Wirtschaftswachstum und Primärrohstoffverbrauch geleistet und außerdem Abhängigkeiten bei Energie- und Rohstoffimporten gesenkt werden. Zudem unterstützen wir nachdrücklich die industrielle Bioökonomie, d. h. die Verwendung biobasierter statt fossilbasierter Produkte und Verfahren. Wir haben Ende 2020 ein Förderprogramm „Industrielle Bioökonomie“ aufgesetzt, mit dem Ziel, im Labormaßstab erprobte biobasierte Produkte und Verfahren in Richtung des industriellen Maßstabs hochzuskalieren sowie neue, skalierte biobasierte Produkte und Verfahren in regionale industrielle Wertschöpfungsnetze zu integrieren.

Das Programm „Entwicklung digitaler Technologien“ wiederum fördert innovative Forschungs- und Entwicklungsprojekte mit Leuchtturmcharakter vorwettbewerblich – unter anderem in den Bereichen Künstliche Intelligenz und Quantencomputing. Wir wollen damit Deutschland als Hightech-Standort stärken und die digitale Souveränität festigen.

e) Digitale Transformation vorantreiben

Deutschland ist unverändert einer der Taktgeber der digitalen Transformation der Industrie hin zu einer datengetriebenen Wirtschaft. Die von der Bundesregierung mitinitiierte Plattform Industrie 4.0, die Wirtschaft, Wissenschaft, Gesellschaft und Politik zusammenbringt, ist Impulsgeber und Trei-

ber für digitale Lösungsansätze und die Entwicklung datenbasierter Ökosysteme in der Industrie.

Die Digitalisierung von Produktionsprozessen und die digitale unternehmens- und branchenübergreifende Vernetzung sind entscheidende Faktoren für die zukünftige Wettbewerbsfähigkeit sowie mehr Resilienz und Nachhaltigkeit. Um das Potenzial der digitalen Transformation voll nutzen zu können, müssen wirtschafts- und industriepolitische Maßnahmen alle Facetten der deutschen Industrie berücksichtigen. Es braucht gezielte Angebote sowie vertrauenswürdige Rahmenbedingungen und Infrastruktur.

Ein zentrales Leuchtturmprojekt für ein datenbasiertes Ökosystem der Automobil- und Zulieferindustrie ist das vom BMWK geförderte Projekt Catena-X. Dort wird ein globaler Datenraum mit durchgängiger Datenkette entlang der gesamten automobilen Wertschöpfung geschaffen. Die starke Beteiligung der Automobilindustrie zeigt: Die Unternehmen brauchen skalierbare digitale Ökosysteme, um für zentrale Themen Lösungen zu bekommen.

Kernprojekt für die digitale Transformation der Industrie ist Manufacturing-X, das auf den Erfahrungen von Catena-X aufsetzt und auf die umfassende Digitalisierung aller industriellen Lieferketten zielt. Dabei soll der gesamte Lebenszyklus von Produkten und Produktionsmitteln – von der Rohstoffgewinnung bis zum Recycling – erfasst werden. Durch einfache Beteiligungsmöglichkeiten und bedarfsgerechte Anwendungskonzepte soll zudem die Digitalisierung des Mittelstands befördert werden. Die Bundesregierung stellt in diesem Zusammenhang bis 2026 rund 150 Mio. Euro für Forschung und Entwicklung bereit, weitere Leuchtturmprojekte sind im Entstehen.

Über die Schaffung von Datenräumen hinaus wollen wir als Bundesregierung die umfassende Nutzung von Daten fördern. In der Datenökonomie liegt großes Potenzial für neue Geschäftsmodelle in der Industrie. Eine wesentliche Grundlage hierfür sind sichere, leistungsstarke und echtzeitfähige Cloud- und Edge-Technologien sowie eine hohe Interoperabilität zwischen Anbietern und Nutzern, um Abhängigkeiten zu verringern. Hierfür treiben wir mit elf weiteren EU-Mitgliedstaaten im Rahmen des IPCEI Next Generation Cloud Infrastructure and Services die Entwicklung einer offenen Cloud-Infrastruktur nach europäischen Prinzipien voran. Beim europäischen Datengesetz – dem „Data Act“ – haben wir uns eingesetzt für eine Balance zwischen dem Anreiz, das Datenteilen zu fördern, und dem Interesse von Unternehmen, ihre Geschäftsgeheimnisse zu schützen. Der Data Act wird die rechtliche Grundlage für eine moderne Datenökonomie legen. Darüber hinaus setzen wir uns für das Teilen von mehr und besseren Daten ein. Die Datenstrategie der Bundesregierung macht deutlich, dass dies eine gesamtgesellschaftliche Aufgabe ist. Daten in Deutschland besser verfügbar zu machen ist zudem eine wichtige Aufgabe des sich im Aufbau befindenden Dateninstituts. Diese Aktivitäten stärken das Vertrauen beim Umgang mit Daten und unterstützen die Datensouveränität in Deutschland.

Die Nutzung und Auswertung von Daten unterstützt zudem die Transformation der Industrie zur Klimaneutralität. Ein digitaler Produktpass kann Daten zu verarbeiteten Rohstoffen, der Nutzung bis hin zum Recycling/Verbrauch des Produkts enthalten. Administrativ entlasten digitale Produktpässe die Industrie durch die Möglichkeit, zum Beispiel Konformitätserklärungen digital bereitzustellen und damit gleichzeitig Papier zu sparen. Vollständig digitalisierte Produktionsabläufe sind wichtig für die Stärkung der Kreislaufwirtschaft.

Aufbauend auf umfassenden Datenquellen mit eigenen Daten und Daten Dritter, wird auch das volle Potenzial von KI-Lösungen als Schlüsseltechnologie sichtbar. Datenzugang/-souveränität ist dabei Voraussetzung, um beim Thema KI den Anschluss zu halten. Neben signifikanten Produktivitätsgewinnen kann der vermehrte Einsatz von KI zu vollkommen neuen Ansätzen und Geschäftsmodellen führen, wie die virtuelle Erstellung und Testung von Chemikalien oder Medikamenten ganz ohne Verbrauch physischer Materialien. Wir setzen uns dabei für eine innovationsfreundliche Ausgestaltung der regulatorischen Rahmenbedingungen für KI in Europa ein, um Potenziale der KI zu nutzen und Investitionen in KI zu fördern. Vertrauenswürdige KI kann so ein Markenzeichen für Europa, ein internationales Vorbild und ein Wettbewerbsvorteil für die Industrie werden.

f) Investitionen anreizen und finanzieren

In den nächsten Jahren braucht es eine erhebliche Verstärkung der Investitionen. Deshalb muss es bei Entlastungen genauso wie bei Förderentscheidungen immer darum gehen, möglichst zielgerichtet dort zu unterstützen und zu entlasten, wo Investitionen angereizt werden. Dies hat die Bundesregierung in ihrer Steuerpolitik seit Beginn der Legislaturperiode geleitet.

Mit einer Reihe von Maßnahmen sorgen wir für gezielte Entlastungen und steuerliche Verbesserungen gerade auch für den Mittelstand. Diese Verbesserungen sind insbesondere darauf ausgerichtet, die Investitionsfähigkeit von Unternehmen und den Umbau auf klimafreundlichere und digitalere Produktionsverfahren gezielt anzureizen und zu fördern, denn hier besteht in den kommenden Jahren massiver privater Investitionsbedarf. Dazu gehören insbesondere Verbesserungen bei den Abschreibungsmöglichkeiten und der steuerlichen Verlustverrechnung, die Ausweitung der steuerlichen Forschungszulage wie auch ein Abbau von Steuerbürokratie z. B. durch Anhebung verschiedener Schwellenwerte. Vor allem mittelständische Unternehmen können zukünftig von einer attraktiveren Thesaurierungsbegünstigung im Einkommensteuerrecht profitieren. Ein weiteres Kernelement des Wachstumschancengesetzes ist die Einführung einer steuerlichen Investitionsprämie. Diese wird per Rechtsanspruch allen Unternehmen zur Verfügung stehen, die in die ökologische Transformation investieren.

Zusammen mit der Übernahme der EEG-Finanzierung in den KTF plant die Bundesregierung, Wirtschaft und Industrie um 50 Mrd. Euro über die nächsten vier Jahre zu entlasten. Von diesen Entlastungen profitieren weit überdurchschnittlich kleine und mittlere Unternehmen.

Die bereits von der Bundesregierung vorgelegten Maßnahmen stärken verantwortlich den Steuerstandort und die Investitionsbedingungen in Deutschland. Darüber hinaus wird mit der Umsetzung der globalen Mindeststeuer der schädliche Steuerwettbewerb zugunsten der Wettbewerbsfähigkeit Deutschlands und zulasten der bekannten Steueroasen eingedämmt. Davon wird auch die deutsche Industrie profitieren.

Ebenso wichtig wie steuerliche Anreize ist aber auch, sicherzustellen, dass Unternehmen vollen Zugang zu einer günstigen Finanzierung ihrer privaten Investitionen haben. Zur Unterstützung des Mittelstands bei der Finanzierung der Transformation wurde das zinsverbilligte Finanzierungsvolumen in den von der KfW durchgeführten ERP-Kreditprogrammen erhöht. Durch eine teilweise Haftungsfreistellung für die Hausbanken wird zudem der Zugang zu einer Finanzierung erleichtert. Das Finanzierungsangebot wird darüber hinaus durch den Ausbau bestehender und durch neue Programme der Kredit- und Beteiligungs-

finanzierung verbessert (bspw.: Erweiterung der Mittelstandsförderung über Bürgschaftsbanken, Einführung Grünes ERP-Globaldarlehen Leasing und KfW-Konsortialkredit Nachhaltige Transformation). Zudem wurde die Start-up- und insbesondere die Wachstumsfinanzierung erheblich gestärkt – bspw. durch die European Tech Champions Initiative zur Förderung großvolumiger Finanzierungsrunden oder den Wachstumsfonds für institutionelle Anleger, mit dem privates Kapital institutioneller Investoren mobilisiert wird.

Außerdem setzen wir uns im europäischen Kontext für die Vollendung der Kapitalmarktunion ein, um bestehende Hindernisse für Kapitalmarktgeschäfte in der Union abbauen und den Zugang von Unternehmen zu Finanzierungen über den Kapitalmarkt erleichtern.

g) Fachkräfte sichern

Die zentrale Aufgabe liegt in den kommenden Jahren nicht länger in der Verhinderung einer drohenden Massenarbeitslosigkeit, sondern in der Sicherung von Fachkräften für die Unternehmen. Gerade der Mittelstand, der oftmals ohne große Personalabteilungen auskommen muss, ist darauf angewiesen, dass der Staat bei der Sicherung von Fachkräften unterstützt und die dazu notwendigen Rahmenbedingungen schafft. Dazu hat die Bundesregierung schon viel in die Wege geleitet. Die neue Fachkräftestrategie bildet den strategischen Rahmen und enthält Maßnahmen, deren Umsetzung in nachgelagerten Prozessen bereits erfolgt ist oder erfolgt. Zentrale Handlungsfelder sind insbesondere die Hebung der nicht ausgeschöpften inländischen Arbeitspotenziale, die Stärkung der Aus- und Weiterbildung und auch die Steigerung der qualifizierten Zuwanderung.

Die erste Stellschraube ist die Steigerung des inländischen Potenzials.

Insbesondere Frauen haben eine im europäischen Vergleich hohe Teilzeitquote von etwa 45 Prozent. Um Frauen zu ermöglichen, länger zu arbeiten, müssen weitere Hemmnisse abgebaut werden. Ein signifikanter Faktor ist hier die Verfügbarkeit von Kinderbetreuung – auch zu Randzeiten –, damit insbesondere Mütter ihre Arbeitszeit überhaupt ausweiten können. Mit dem Kita-Qualitätsgesetz hat die Bundesregierung in dieser Legislatur hier bereits Schritte zu einer Verbesserung unternommen.

Bei älteren Menschen gibt es ebenfalls ein signifikantes Potenzial, das Arbeitsvolumen auszuweiten. Gerade auf das Wissen, Können und die Erfahrung von älteren Menschen sollten wir nicht verzichten. Deshalb bedarf es gezielter Anreize, damit ältere Menschen freiwillig länger arbeiten können. Trotz erheblicher Erfolge bei der Arbeitsmarktbeteiligung Älterer bleiben zum Beispiel vorgezogene Altersrenten weiterhin beliebt und Arbeit im Alter oft auf Minijobs beschränkt. Bei mehr Erwerbsarbeit älterer Menschen muss es um Freiwilligkeit und Anreize gehen. Die Bundesregierung hat durch die Abschaffung der Hinzuverdienstgrenzen bei vorgezogenen Altersrenten zum 1. Januar 2023 schon einen wichtigen Schritt in diese Richtung gemacht. Das BMWK hält aber weitere Maßnahmen für notwendig, um eine einvernehmliche Weiterarbeit einfach möglich und finanziell attraktiver zu machen. Eine wesentliche und sich offensichtlich anbietende Maßnahme zur Förderung einer Beschäftigung neben dem Rentenbezug wäre die Auszahlung des Arbeitgeberbeitrags zur gesetzlichen Arbeitslosen- und Rentenversicherung nach Erreichen der Regelaltersgrenze direkt an die Arbeitnehmer, so wie es bisher bereits beim Arbeitnehmerbeitrag gehandhabt wird. Alternativ dazu wäre ein steuerlicher Freibetrag für sozialversicherungspflichtige Beschäftigte oberhalb der Regelaltersgrenze denkbar. Die Anreize sollten in jedem Falle so gestaltet werden, dass die heutigen Anreize

zur Beschränkung der Erwerbsarbeit im Alter durch fixe Schwellenwerte überwunden werden. Als weiteren Schritt sollten gemeinsam mit den Sozialpartnern Lösungen für eine Flexibilisierung des fixen Beendigungszeitpunktes in Arbeitsverträgen bei Erreichen der Regelaltersgrenze gefunden werden.

Weiteres Fachkräftepotenzial liegt in der Qualifizierung von ungelernten Arbeitskräften. 2021 hatten rund 2,65 Mio. junge Menschen zwischen 20 und 35 Jahre keinen Berufsabschluss. Diese Menschen können potenziell durch eine duale Berufsausbildung als Fachkräfte in den Arbeitsmarkt integriert werden. Insbesondere die im europäischen Vergleich geringe Jugendarbeitslosigkeit lässt sich auf das System der dualen Ausbildung zurückführen. Um Menschen in eine duale Ausbildung zu bringen, arbeitet die Bundesregierung eng mit den Stakeholdern in der Allianz für Aus- und Weiterbildung zusammen. Des Weiteren gilt es, mehr junge Menschen für eine Ausbildung in den Transformationsberufen sowie in vielen anderen Tätigkeitsfeldern zu gewinnen. Daher wirbt das BMWK in seiner Fachkräftekampagne „Gemacht für was Großes“ auch konkret für eine Ausbildung in den Klimaberufen.

Das Potenzial von Geflüchteten kann durch gezielte Arbeitsmarktintegration gehoben werden. Das IAB zeigte kürzlich, dass 54 Prozent der Geflüchteten nach sechs Jahren erwerbstätig sind, wobei es ein erhebliches Gefälle zulasten der Frauen gibt. In der kurzen und mittleren Frist ist insb. die erfolgreiche Integration der mehr als 500 Tsd. schutzsuchenden Ukrainerinnen und Ukrainer von Relevanz. Zentral für eine erfolgreiche Arbeitsmarktintegration ist in erster Linie das schnelle Erlernen der deutschen Sprache, die zügige Anerkennung von Berufsabschlüssen sowie das Angebot von Aus- und Weiterbildungsmaßnahmen. Außerdem sollen rechtliche Hürden der Arbeitsmarktintegration gezielt abgebaut werden: Hierzu hat die Bundesregierung diverse Maßnahmen vereinbart. Unter anderem werden die aktuell noch bestehenden Arbeitsverbote während des Asylverfahrens punktuell gelockert, die Erteilung von Beschäftigungserlaubnissen für Geduldete als Regelfall festgeschrieben sowie die Möglichkeit der sog. Beschäftigungsduldung erweitert. Hierdurch erhalten auch Arbeitgeber Sicherheit darüber, ihre gut integrierten Mitarbeiter nicht plötzlich wieder zu verlieren. Durch die vereinbarten Maßnahmen wird die Möglichkeit gestärkt, zügig und vor allem dauerhaft in den Arbeitsmarkt zu kommen.

Zweite wichtige Stellschraube zur Bekämpfung des Fachkräftemangels und damit zur Sicherung des Industriestandorts ist die erleichterte Einwanderung von Arbeitskräften, insbesondere von qualifizierten Fachkräften. Zu lange wurde in Deutschland davon ausgegangen, dass sich der Standort auch ohne nennenswerte Einwanderung wettbewerbsfähig halten ließe, dabei sprachen demographische Entwicklung und Arbeitsmarktdaten schon seit Jahren eine andere Sprache. Die Bundesregierung hat hier seit ihrem Amtsantritt ein umfassendes Umdenken eingeleitet und es sich zur zentralen Aufgabe gemacht, den Zugang der deutschen Wirtschaft und insbesondere der deutschen Industrieunternehmen zu Fachkräften nachhaltig und langfristig auch durch Einwanderung zu sichern.

Die zentrale Maßnahme dafür ist das im Sommer 2023 beschlossene neue Fachkräfteeinwanderungsrecht – bestehend aus Gesetz und Verordnung zur Weiterentwicklung der Fachkräfteeinwanderung, welches die Einwanderung von Fach- und Arbeitskräften vereinfacht und beschleunigt.

Die Inhalte von Gesetz und Verordnung werden ab dem 18.11.2023 schrittweise in Kraft treten. Um die erfolgreiche Umsetzung der rechtlichen Vorgaben zu unterstützen, hat die Bundesregierung weitere

Begleitmaßnahmen beschlossen. Diese umfassen u. a. verstärkte Werbung unter der Dachmarke „Make it in Germany" – dem Portal des Bundes für Fachkräfte aus dem Ausland, eine Beschleunigung und Vereinfachung der Visa- und Verwaltungsverfahren sowie die Senkung der Anerkennungshürden.

Um vom Strukturwandel betroffene Arbeitsplätze zu sichern und Beschäftigten eine Zukunft in den Transformationssektoren zu bieten, sind drittens Qualifizierung und Weiterbildung essenziell. Die Herausforderung besteht darin, Beschäftigte nach den zukünftigen Bedürfnissen der Unternehmen aus- und weiterzubilden. Mit dem Gesetz zur Stärkung von Aus- und Weiterbildung hat die Bundesregierung in diesem Jahr die Förderinstrumente der Arbeitsmarktpolitik weiterentwickelt, um der beschleunigten Transformation in der Arbeitswelt zu begegnen und strukturwandelbedingte Arbeitslosigkeit zu vermeiden. Ein zentrales Instrument ist das neu eingeführte Qualifizierungsgeld, das am 1. April 2024 in Kraft tritt. Es kommt Betrieben zugute, die durch den Strukturwandel Arbeitsplätze abbauen müssten, aber durch Weiterbildung eine zukunftssichere Beschäftigung im gleichen Betrieb ermöglichen können.

h) EU-Binnenmarkt stärken

Der EU-Binnenmarkt ist ein zentraler Standortfaktor für die deutsche Industrie: Ihre Wertschöpfungsketten ziehen sich durch ganz Europa und die EU ist gleichzeitig ihre wichtigste Exportdestination. Die tiefe ökonomische und politische Integration in der EU schafft einheitliche Standards, Rechtssicherheit und einen weltweit einzigartigen gegenseitigen Marktzugang. Der Binnenmarkt ist ein Verstärker für gute Ideen und neue Produkte der Industrie. Gerade Deutschland als Exportnation nicht nur, aber vor allem von Industriegütern ist besonders darauf angewiesen, dass der Binnenmarkt funktioniert, dass Grenzen offenbleiben und die europäische Integration weiter voranschreitet und vertieft wird.

Ein starker Binnenmarkt braucht einheitliche Standards und ihre effektive Durchsetzung, um die ökologische Nachhaltigkeit und den sozialen Ausgleich zu sichern und grüne Leitmärkte entwickeln zu können. Harmonisierte Vorgaben dienen, wenn sie einfach und in sich stimmig sind, dem Abbau bürokratischer Hindernisse und erleichtern den Unternehmen, gerade auch aus dem Mittelstand, das grenzüberschreitende Tätigwerden. Neben Harmonisierungen etwa im Produkt- und Dienstleistungsbereich unterstützen wir die Schaffung gemeinsamer Binnenmarktregelungen mit breiterem industriepolitischem Ansatz (NZIA, CRMA).

Daneben ist ein zukunftsweisendes Wettbewerbsrecht zutiefst im deutschen Interesse. Faire Wettbewerbsbedingungen für Unternehmen überall in der EU sind gerade für deutsche Unternehmen mit Standorten in vielen europäischen Partnerländern eine wesentliche Erfolgsvoraussetzung. Außerdem ist ein funktionierender Wettbewerb eine wesentliche Triebfeder für Innovationen und Neugründungen. Folgende Aspekte sind für uns hierbei zentral:

Erstens gilt es, gerade in Zeiten der grünen und digitalen Transformation mehr denn je rasche Handlungsfähigkeit für die Mitgliedstaaten sowie Planungssicherheit für Unternehmen zu gewährleisten. Zu lange Prozesse und mangelnde Planungssicherheit wirken sich im direkten Vergleich mit den z. B. im Rahmen des von der US-Administration im Inflation Reduction Act vorgesehenen Tax Credits als echter Wettbewerbsnachteil aus. Die nächste EU-Kommission sollte es sich auf die Fahnen schreiben, die Prozesse erheblich zu beschleunigen.

Zweitens muss das Wettbewerbsrecht auf die globale Wettbewerbssituation und die tatsächlichen Handlungsmöglichkeiten der EU ausgerichtet sein. Es ist wichtig, dass innerhalb der EU fairer Wettbewerb herrscht – aber dieser faire Wettbewerb darf nicht um den Preis hergestellt werden, dass europäische Firmen global ins Hintertreffen geraten. Deshalb müssen wir dafür Sorge tragen, dass nationale Industriepolitiken nicht am Beihilferecht scheitern, die zur Erneuerung unseres Wohlstands oder aus Gründen der Wirtschaftssicherheit im gesamteuropäischen Interesse sind.

2.2 Aufbauen, was uns sichert

Der russische Angriffskrieg auf die Ukraine und seine wirtschaftspolitischen Folgen haben uns vor Augen geführt, dass es für die Resilienz unserer Volkswirtschaften wie für unsere außenpolitische Handlungsfähigkeit von entscheidender Bedeutung ist, ob unsere Industrie für ihre Produktion von Autokratien direkt oder indirekt abhängt. Direkt, weil Rohstoffe und Vorprodukte von dort bezogen werden; indirekt, weil aggressive Handlungen von Autokratien Lieferketten empfindlich stören können.

Diese Bedeutung wurde in den letzten Jahrzehnten zu oft nicht gesehen. Sicherheitspolitische Risiken und volkswirtschaftliche Kosten wurden oft ausgeblendet. Seit ihrem Amtsantritt hat die Bundesregierung diese Schieflage Schritt für Schritt korrigiert und ihre Politik konsequent auf einen ganzheitlichen Ansatz umgestellt, der die Interessen deutscher Unternehmen und ihrer Beschäftigten mit der notwendigen Stärkung der deutschen und europäischen Wirtschaftssicherheit in Einklang bringt. Dafür hat sie unter anderem die Nationale Sicherheitsstrategie und die Chinastrategie verabschiedet.

Industriepolitisch übersetzt sich dieser neue Ansatz in drei Bausteinen:

Erstens führt der Weg zu mehr Wirtschaftssicherheit nicht über mehr Protektionismus und Abschottung, sondern über mehr Offenheit und Diversifizierung. Dafür hat die Bundesregierung neue Dynamik in die Handelspolitik gebracht. Wir haben die Blockaden bei CETA gelöst und die Verhandlungen für Abkommen mit einer ganzen Reihe von Staaten überall auf der Welt intensiviert. Wir richten gleichzeitig unsere außenwirtschaftspolitischen Instrumente neu aus und schauen genauer hin, wer hier investieren will und wohin deutsche Technologie abfließen könnte.

Zweitens hat uns die Abwägung der geopolitischen und volkswirtschaftlichen Risiken zu der Einschätzung geführt, dass in bestimmten Bereichen eigene Produktionskapazitäten unerlässlich sind. Das gilt in der Zeitenwende natürlich zuallererst für die Rüstungsindustrie: Wir müssen in Europa in der Lage sein, relevante Anteile unseres Bedarfs und des Bedarfs unserer engsten Verbündeten an Rüstungsgütern selbst zu decken. Dafür wollen wir auch Schritte zu einer verstärkten Kooperation im Sicherheits- und Verteidigungssektor und zur weiteren Konsolidierung der europäischen Rüstungsindustrie in Angriff nehmen. Dies dient der Stärkung der strategischen Souveränität Europas.

Die Notwendigkeit für eigene Produktionskapazitäten gilt aber auch für Halbleiter als unverzichtbare Basis der modernen Industrieproduktion und für zentrale Technologien für die Energiewende und für die Dekarbonisierung der Industrie. Auch in diesen Fällen gibt es gute Gründe anzunehmen, dass Deutschland auf lange Sicht ein führender Standort in diesen Industrien sein kann, weil wir hier die richtigen Standortbedingungen bieten können. Aber in beiden Fällen gilt auch, dass ohne

groß angelegte finanzielle Unterstützung durch den Staat eine Ansiedlung gerade wegen der massiven Subventionierung in anderen Teilen der Welt unrealistisch ist, während sie gleichzeitig enorme positive Effekte auf unsere Wirtschaftssicherheit in Europa hat. In dieser Situation hat sich die Bundesregierung entschieden, mit großem Volumen die Ansiedlung von Produktionskapazitäten zu fördern – und hat bereits erfolgreich eine ganze Reihe von Unternehmen überzeugt, nach Deutschland zu kommen. Dabei geht es uns auch darum, bestehende Stärken zu stärken – etwa im Bereich Leistungshalbleiter oder Mikrocontroller. Solche Stärken unterstützen unsere außenpolitische Handlungsfähigkeit und Souveränität.

Drittens haben Corona-Pandemie und der russische Angriffskrieg gegen die Ukraine und die daraus resultierenden Engpässe und Lieferschwierigkeiten für Rohstoffe und Vorprodukte die Risiken solcher Abhängigkeiten offenbar gemacht. Bei dem zunächst absehbar weiter steigenden Bedarf an mineralischen und metallischen Rohstoffen im Rahmen der Transformation werden sich diese Abhängigkeiten ohne entschiedenes Gegensteuern ggf. noch verstärken. Wir haben deshalb die Rohstoffstrategie der Bundesregierung aus dem Jahr 2020 in entscheidenden Punkten fortgeschrieben und konkretisiert. Die Schwerpunkte der neuen Ausrichtung der Rohstoffpolitik sind erstens der Ausbau von Kreislaufwirtschaft, Ressourceneffizienz und Recycling, zweitens eine stärkere Diversifizierung der Rohstofflieferketten durch den Ausbau von internationalen Rohstoffpartnerschaften inklusive der Stärkung des heimischen Bergbaus sowie drittens die Sicherstellung eines fairen und nachhaltigen Marktrahmens durch die Entwicklung und Anwendung wirksamer ESG-Standards, mit denen wir uns Vorteile im internationalen Wettbewerb um Rohstoffe sichern können.

Die Bundesregierung hat in diesen Bereichen in den letzten 21 Monaten eine Vielzahl von Maßnahmen auf den Weg gebracht:

a) Horizontale Maßnahmen zur Stärkung der Wirtschaftssicherheit

Unser Wohlstand fußt zu gewichtigen Teilen auf Deutschlands Erfolg als Exportland – und Industriegüter made in Germany sind dabei ein wichtiges Pfund. Deutschland exportiert jedes Jahr Waren im Wert von rund 1.500 Mrd. Euro. Voraussetzung für diesen Erfolg ist dabei nicht nur die Europäische Integration mit dem Binnenmarkt als ihr Herzstück, sondern auch andere gute Handelsbeziehungen mit Staaten überall auf der Welt im Rahmen eines funktionierenden Welthandelssystems.

Funktionierende, diversifizierte Handels- und Investitionsbeziehungen sind dabei nicht nur eine ökonomische Notwendigkeit für Deutschland als Exportland; sie sind ein zentraler Beitrag zu mehr europäischer Wirtschaftssicherheit, weil sie die kritische Abhängigkeit von einzelnen Drittstaaten verringern. Dabei haben Unternehmen ein erhebliches Eigeninteresse an der Reduzierung ihrer Abhängigkeiten von einzelnen Absatzmärkten, Bezugsquellen sowie innerhalb ihrer Wertschöpfungs- und Lieferketten. Dazu gehört eine fortlaufende Risikoanalyse durch die Unternehmen, die auch geoökonomische Fragestellungen einschließt. Im Rahmen der Diversifizierungsstrategie unterstützen wir diese Bemühungen durch Wirtschaftsdiplomatie und eine effektive Außenwirtschaftsförderung. So werden deutsche Unternehmen bei der Erschließung neuer Beschaffungs- und Absatzmärkte unterstützt, indem Investitionsgarantien für Diversifizierungsziele zu besonders günstigen Deckungskonditionen angeboten werden.

Außerdem haben wir als Bundesregierung nach Jahren der Blockade unsere handelspolitische Sprache wiedergefunden und mit unserer Handelsagenda neue Leitplanken für eine beidseitige faire Handelspolitik mit einem verbindlichen Kapitel über Handel und nachhaltige Entwicklung auf Augenhöhe gelegt. Auch deshalb konnte das CETA-Abkommen mit Kanada endlich ratifiziert werden. Weitere Abkommen in Lateinamerika und im Indo-Pazifik treiben wir in diesem Sinne entschieden voran. Dabei setzen wir auch auf die Achtung der grundlegenden Arbeitnehmerrechte und des Pariser Abkommens als wesentliche Elemente der Handelsabkommen. Auf der Basis der Handelsagenda schaffen wir ein nachhaltigeres und faires Angebot und erschließen für die deutsche und europäische Industrie neue Märkte. Zudem setzen wir auch weiterhin auf freien und fairen Welthandel, von dem der deutsche Außenhandel ganz besonders profitiert. Wir brauchen besonders für die deutsche Industrie ein weltweites Level-playing-field. In der Exportfinanzierung haben wir speziell für kleinvolumige Geschäfte die Liquiditätsversorgung für kleine und mittlere Unternehmen gestärkt und die sog. Forfaitierungsgarantie bei den Hermesbürgschaften eingeführt. Durch das verbesserte Finanzierungsangebot wird der Weg auch in herausfordernde Märkte erleichtert und die Diversifizierung von Märkten und Lieferbeziehungen befördert.

Gleichzeitig haben wir auf die veränderten geopolitischen Rahmenbedingungen reagiert: Wir analysieren die Risiken und geoökonomischen Herausforderungen für die Volkswirtschaft und werden anhand dessen unser Instrumentarium überprüfen und wo nötig schärfen. Dies tun wir gemeinsam mit unseren Partnern in der EU und weltweit. Die Strategie zur Wirtschaftssicherheit von Europäischer Kommission und Hohem Vertreter der Union für die Außen- und Sicherheitspolitik vom 20. Juni 2023 setzt auf die Stärkung der Wettbewerbsfähigkeit und der technologischen Souveränität, auf einen besseren Schutz vor Risiken für die Wirtschaftssicherheit sowie die Stärkung der Zusammenarbeit mit einem breiten Spektrum von Partnern und die Förderung von Handelsabkommen. Bei alledem gilt, dass wir ein hohes Maß an Offenheit in den Handels- und Investitionsbeziehungen mit einer Stärkung der Resilienz und einer Verringerung volkswirtschaftlicher Risiken austarieren. Maßnahmen, die wir treffen, werden verhältnismäßig sein.

Eine kluge Standortpolitik, v. a. für die Schlüsselsektoren und Zukunftsbranchen, ist Voraussetzung für den Industriestandort Deutschland. Um aber unzulässigen Wettbewerbsverzerrungen wirksam entgegenzutreten, setzen wir auf eine konsequente Anwendung der handelspolitischen Schutzmaßinstrumente der EU (Anti-Dumping-, Anti-Subventionsschutzinstrumente). Das BMWK begrüßt zudem den EU-Verordnungsentwurf über den Schutz vor wirtschaftlichem Zwang durch Drittstaaten, dem das Europäische Parlament am 3. Oktober 2023 mit überwältigender Mehrheit zugestimmt hat. Damit schützen wir die Souveränität Europas dort, wo Drittstaaten Handel und Investitionen als Waffe einsetzen, um eine bestimmte Entscheidung herbeizuführen („weaponisation of trade“).

Investitionsprüfungen haben in Deutschland und Europa in den letzten Jahren deutlich an Bedeutung gewonnen. Deutschland wird ein offener Investitionsstandort bleiben, in dem ausländische Investitionen hoch willkommen sind. Allerdings dürfen sie unsere Sicherheit nicht beeinträchtigen. Um den aktuellen Herausforderungen noch schlagkräftiger begegnen zu können, wird innerhalb der Bundesregierung eine Weiterentwicklung des Investitionsprüfungsrechts geprüft. Schwerpunkte liegen u. a. auf der Modernisierung der bestehenden Branchen-Fallgruppen, bei deren Betroffenheit eine Meldepflicht und niedrigere

Prüfeintrittsschwellen gelten, und der besseren Erfassung der Übertragung von geistigem Eigentum an relevanten Technologien (z. B. über Lizenzvereinbarungen).

Darüber hinaus werden wir die bestehenden rechtlichen Möglichkeiten nutzen, um sensible Technologieabflüsse, die zur Proliferation von Massenvernichtungswaffen, unkontrollierter konventioneller Aufrüstung oder internen Repression und zu Menschenrechtsverletzungen missbraucht werden können, zu unterbinden. Wir entwickeln die Exportkontrolle weiter. Dazu werden wir uns eng mit unseren europäischen und internationalen Partnern abstimmen. Mit Blick auf Investitionen im Ausland wollen wir gemeinsam mit unseren Partnern verhindern, dass autokratische Staaten ihre militärischen und nachrichtendienstlichen Fähigkeiten mithilfe des Kapitals, der spezifischen Fachkenntnisse, Netzwerken und des Wissens unserer Unternehmen verbessern können. Wir prüfen mit unseren europäischen Partnern in einer Expertengruppe, inwieweit ergänzende Maßnahmen sinnvoll sind, um solchen Risiken im Zusammenhang mit Auslandsinvestitionen entgegenzutreten.

b) Mikroelektronikindustrie

Mikroelektronik ist der Schlüssel für viele Digitalisierungs- und Transformationsprozesse und das entscheidende Ausgangsprodukt für die meisten Industrieprodukte der Zukunft. Mikroelektronikkomponenten und Halbleiterchips sind elementare Bausteine für den Ausbau Erneuerbarer Energien, für Effizienzsteigerungen bei der Energienutzung, für die Entwicklung von e-Mobilität, künstlicher Intelligenz, Hochleistungsrechnern oder neuen Telekommunikationsstandards (5G/6G). Doch auch jenseits der Zukunftstechnologien sind nahezu alle Industrien und Branchen auf Mikroelektronik angewiesen. Sie ist mithin Motor für Innovation, Wertschöpfung und Beschäftigung. Ein unabhängiger und sicherer Zugang zu vertrauenswürdiger Mikroelektronik ist daher unerlässlich.

Die Mikroelektronikindustrie in Deutschland und Europa verfügt mit Leistungshalbleitern, Sensorik, Mikrocontrollern, dem Anlagenbau, der Waferproduktion und der Designsoftwareentwicklung über starke Kompetenzen. Jedoch übersteigt die Nachfrage nach mikroelektronischen Bauteilen die Produktionskapazitäten in Europa. Unternehmen in Deutschland und Europa sind daher in hohem Maße auf Importe angewiesen. Produktions- und Designkapazitäten für Mikroelektronik über alle Strukturgrößen und Chiparten hinweg liegen derzeit überwiegend in Asien und den USA. Dort halten Marktakteure darüber hinaus große Anteile in anderen wichtigen Segmenten der Wertschöpfungskette, etwa bei der Entwicklung unterstützender Software, der Produktion von Chemikalien oder der Backend-Fertigung (Assembly, Test, Packaging). Die Wertschöpfungs- und Lieferketten der Mikroelektronik sind global eingebettet, bergen damit aber Risiken von Lieferkettenstörungen oder Abhängigkeiten, zumal der globale Wettbewerb der chipproduzierenden Regionen zunehmend in einem geo- und sicherheitspolitischen Kontext steht.

Zur Sicherung der technologischen Souveränität und Wettbewerbsfähigkeit ist daher der Ausbau von Forschungs-, Entwicklungs- und Fertigungskapazitäten für Halbleitertechnologien und -anwendungen in Deutschland und Europa essentiell. Dabei gilt es, bestehende Kompetenzen zu stärken und kritische technologische Lücken zu schließen. Gleichzeitig müssen aktuelle und künftige Anforderungen der Anwenderindustrien berücksichtigt werden. Dies umfasst auch eine gezielte Förderung des Fachkräftenachwuchses in der Mikroelektronik. Wir setzen daher hohe Fördermittel und Maßnahmen ein, um private Investitionen entlang der Wertschöpfungskette anzureizen und sichere und nachhaltige Mikroelektronik

„Made in Germany“ und „Made in Europe“ voranzutreiben. Diese Maßnahmen zahlen auf die Ziele der Europäischen Kommission ein, Europas Kapazitäten an der weltweiten Halbleiterproduktion bis 2030 auf 20 Prozent zu verdoppeln und das Halbleiter-Ökosystem in der EU insgesamt zu stärken. Europäische Instrumente wie das IPCEI (Important Project of Common European Interest) oder der European Chips Act setzen wichtige Investitionsanreize und beihilferechtliche Rahmenbedingungen, um eine gezielte Förderung zu ermöglichen.

Zur Stärkung von Innovation und ihrer Überführung in industrielle Produktion unterstützen wir mit dem IPCEI gemeinsam im europäischen Verbund die Forschung und Entwicklung von Mikroelektronik bis zu ihrer ersten industriellen Anwendung. Mit dem ersten IPCEI Mikroelektronik wurden 18 deutsche Unternehmen mit bis zu einer Milliarde Euro dabei unterstützt, moderne Chip-Fabriken zu errichten und leistungsfähige, energieeffiziente Mikroelektronikkomponenten zu entwickeln. Mit einem zweiten, noch umfassenderen IPCEI Mikroelektronik (IPCEI Mikroelektronik und Kommunikationstechnologien) unterstützen wir zusammen mit elf Bundesländern 31 deutsche Projekte mit rund 4 Mrd. Euro bei der Entwicklung von leading- und cutting-edge-Mikroelektronikprodukten, vom Rohmaterial über den Wafer zur Produktionsausrüstung, der Chipherstellung oder -verarbeitung bis zur Anwendung. Insgesamt werden private Investitionen in hoher zweistelliger Milliardenhöhe angestoßen. Es entstehen mehrere Tausend hochqualifizierter Arbeitsplätze in der Halbleiterindustrie sowie in vor- und nachgelagerten Industrien.

Doch der globale Wettbewerb ist immens: Weltweit werben chipproduzierende Regionen mit massiven Förderprogrammen um Halbleiterhersteller. Bau und Betrieb von modernen Halbleiterfabriken stellen Unternehmen vor große finanzielle Herausforderungen, oft in Milliardenhöhe. Mit dem Ziel, die Chipversorgung zu stärken, unterstützen wir daher auf Grundlage des European Chips Act Ansiedlungs- und Ausbauvorhaben von Halbleiterherstellern in Deutschland. Diese Investitionen müssen neueste Technologien nach Deutschland und Europa bringen. Großinvestitionen, etwa von Intel in Magdeburg oder TSMC in Dresden, bilden dabei Kristallisationspunkte für die Entstehung eines Ökosystems aus vor- und nachgelagerten Industrien und Zulieferern.

c) Transformationstechnologien

Um die klimapolitischen Ziele der Bundesrepublik zu erreichen, ist ein beispielloser Ausbau der Erneuerbaren Energien erforderlich. Bei den dafür benötigten Anlagen ist Deutschland bisher in einem hohen Maße vom außereuropäischen Ausland abhängig. So werden etwa Zellen für Solarmodule weit überwiegend in China produziert, von dort stammen auch ca. 60 Prozent der weltweit produzierten Windturbinen. Krisenbedingte Unterbrechungen von Lieferketten und neue geostrategische Gegebenheiten infolge des Angriffskrieges von Russland auf die Ukraine stellen erhebliche Risiken für die Funktionsfähigkeit der entsprechenden Wertschöpfungsketten dar.

Unsere Antwort auf diese Situation hat zwei Teile: Erstens arbeiten wir mit Hochdruck an einer Diversifizierung der Wertschöpfungsketten. Zweitens aber ist auch der Aufbau von Produktionsstätten in Deutschland und in der EU im Bereich der Transformationstechnologien notwendig, um diese bei Bedarf hochskalieren zu können und das notwendige Know-how in Europa zu halten. Daher unterstützen wir den Hochlauf der deutschen und europäischen Produktion der Transformationstechnologien (Photovoltaik, Wind, Batterien, Netzkomponenten, Elektrolyseure, Großwärmepumpen, CCU/CCS). Dies steht auch im Einklang mit

den Zielen des von der Kommission vorgeschlagenen Net-Zero Industry Act, der bald verabschiedet werden sollte.

Zum Aufbau eigener Produktionskapazitäten haben wir 2022 einen Stakeholderdialog zu industriellen Produktionskapazitäten für die Energiewende (StiPE) initiiert, der im Dezember 2022 mit der Veröffentlichung von Handlungsempfehlungen erfolgreich abgeschlossen werden konnte. Einige der Handlungsempfehlungen werden bereits durch bestehende Maßnahmen adressiert, andere werden nun umgesetzt.

Um gezielt Anreize für den Auf- und Ausbau heimischer Produktionskapazitäten zu setzen, sollen bspw. Investitionen in Leuchtturmprojekte der PV-Industrie gefördert werden. Dazu haben wir im Sommer 2023 ein Interessenbekundungsverfahren durchgeführt, das ein hohes Interesse seitens der Industrie und eine hohe Bereitschaft, zu den o. g. Zielen beizutragen, verdeutlicht. Die beihilferechtliche Möglichkeit einer Förderung ist dabei durch den Befristeten Krisenrahmen der EU, das Temporary Crisis and Transition Framework (TCTF), gegeben, der auch zur Investitionsförderung der anderen Transformationsindustrien genutzt werden soll. Darauf baut auch die am 15.08.2023 veröffentlichte Bundesförderung „Resilienz und Nachhaltigkeit des Ökosystems der Batteriezellfertigung“ auf, mit der strategische Investitionen und Großprojekte zur Stärkung der Batterie-Wertschöpfungskette, von den Rohstoffen bis zur Batteriezelle und der anschließenden Wieder- und Weiterverwertung, gefördert werden.

Um einen wirksamen Beitrag zur energiepolitischen und technologischen Souveränität Deutschlands leisten zu können, müssen Investitionen in die Transformationstechnologien zwingend eine langfristige Perspektive haben und sich rentieren. Dafür können die Stärken der Industrie am Standort Deutschland und Europa wie innovative und umwelt- sowie klimaschonende und hocheffiziente Fertigungsmethoden genutzt werden. Um den Produktionshochlauf zu unterstützen und eine langfristige Marktperspektive zu eröffnen, sollten bei öffentlichen Vergaben und Ausschreibungen jenseits des reinen Preises auch qualitative Kriterien wie beispielsweise die CO_2-Intensität oder der Beitrag zur Resilienz zur Anwendung kommen können.

Der beschleunigte Ausbau der Erneuerbaren Energien geht auch mit größeren Projekt- und Investitionsvolumina einher. Um die Umsetzung der Projekte und den Hochlauf der Produktion nicht zu gefährden, werden Absicherungsinstrumente diskutiert, welche die besonderen Risiken von Herstellern insbesondere im Rahmen des Windenergieausbaus, aber auch von Netzkomponenten und weiteren Schlüsseltechnologien abfedern sollen. Hier besteht temporär der Bedarf nach angepassten oder auch neuen Instrumenten (Finanzierung, Garantien, Bürgschaften). Unter Berücksichtigung der EU-beihilferechtlichen Rahmenbedingungen prüfen wir daher unter anderem die temporäre Erweiterung bereits bestehender Instrumente wie KfW-Förderprogramme.

d) Rohstoffe und Kreislaufwirtschaft

Wir haben zu Beginn des Jahres 2023 die Rohstoffstrategie der Bundesregierung fortgeschrieben und konkretisiert. Zu den zentralen Maßnahmen zählen die Stärkung der Kreislaufwirtschaft und die Unterstützung der Unternehmen bei der Diversifizierung ihrer Rohstoffversorgung. So sollen Hemmnisse und rechtliche Hürden für den Einsatz von Recyclingrohstoffen identifiziert und abgebaut sowie Normen, Standards angepasst werden. Zu den Eckpunkten gehört weiterhin ein verstärktes Monitoring über die Situation auf den Rohstoffmärkten. Im September 2023 hat dazu die DERA

einen „Recyclingatlas für die Metallerzeugung“ veröffentlicht. Mit den Eckpunkten wird weiterhin die strategische Ausrichtung der internationalen Zusammenarbeit im Rohstoffbereich gestärkt, durch Auf- und Ausbau von internationalen bilateralen und regionalen Partnerschaften und Untersetzung durch konkrete Projekte und Initiativen von Unternehmen und wissenschaftlichen Einrichtungen. Im Rahmen des Critical Raw Material Act (CRMA) soll die Entwicklung kohärenter ESG-Standards (Environment, Social, Governance) für den Import von Rohstoffen und deren weiterverarbeitete Produkte unterstützt werden. Zudem ist im Rahmen des CRMA vorgesehen, die Gewinnung von Rohstoffen in der EU zu stärken.

Teil unserer weiteren Maßnahmen ist ein Förderprogramm „Rohstoffe für die Transformation“, das im Jahr 2024 starten wird. Das Forschungs- und Entwicklungsprogramm soll Projekte unterstützen, die auf Gewinnung, Verarbeitung oder Recycling bei den für die Transformationstechnologien grundlegenden und versorgungskritischen Rohstoffen abzielen. Wir berücksichtigen dabei stets besonders die Erfordernisse des Mittelstands. Unter anderem setzen wir die Beratung und Unterstützung von kleinen und mittleren Unternehmen mit Blick auf eine nachhaltige und resiliente Rohstoffversorgung fort.

Dadurch könnte z. B. die Entwicklung und Anwendung KI-basierter Verfahren zur Identifizierung und Rückgewinnung von Rohstoffen sowie von Teilen oder Komponenten gefördert werden, die versorgungskritische Rohstoffe wie z. B. seltene Erden enthalten. Zudem könnte die Entwicklung neuer kreislaufbasierter Geschäftsmodelle gefördert werden, die z. B. auf einer Rücknahme, Wiederverwendung und Aufbereitung von Produkten oder Komponenten basieren.

Darüber hinaus sollen über einen Rohstofffonds zudem Rohstoffprojekte, inklusive solcher zum Recycling, unterstützt werden. Dies soll mittels eines Eigenkapitalinstrumentes erfolgen. Die Arbeiten an der konkreten Ausgestaltung des Rohstofffonds laufen. Dieser wird in enger Kooperation mit den europäischen Partnern und enger Verzahnung mit dem von der Europäischen Kommission vorgeschlagenen Critical Raw Material Acts (CRMA) erarbeitet.

Wichtig für unsere Rohstoffversorgung ist der heimische Bergbau. Denn Rohstoffe, die wir vor Ort gewinnen, sind sicher und werden unter höchsten ökologischen und sozialen Standards gefördert. Das Bergrecht setzt den Rechtsrahmen für diesen heimischen Abbau. Derzeit erarbeitet die Bundesregierung Eckpunkte zur Modernisierung des Bergrechts, um den heimischen Rohstoffabbau ökologisch auszugestalten und zu erleichtern. Hierzu hat sie akademische Fachleute sowie Bergjuristinnen und -juristen der Bundesländer konsultiert, die die Vorgaben des Bundesberggesetzes ausführen.

Zur Stärkung der Kreislaufwirtschaft erarbeitet die Bundesregierung derzeit eine nationale Kreislaufwirtschaftsstrategie (NKWS). Der Abschluss der Strategie ist für 2024 vorgesehen. Als konkrete Handlungsfelder werden derzeit Kunststoffe, Fahrzeuge und Batterien, IKT & Elektrogeräte, Metalle, Gebäude, Bekleidung & Textilien, zirkuläre Produktionsprozesse, EE-Anlagen oder die öffentliche Beschaffung bearbeitet. In den Arbeitsprozess fließen auch die Vorschläge der Dialogplattform Recyclingrohstoffe der Deutschen Rohstoffagentur (DERA) zur Förderung der Kreislaufwirtschaft ein, die diese im Rahmen der Rohstoffstrategie der Bundesregierung von 2020 über zwei Jahre erarbeitet hat. Dazu zählen z. B. eine rechtssichere Abgrenzung von Beginn und Ende der Abfalleigenschaft, Vorschläge zur Verbesserung der Getrennthaltung

von Abfällen oder die Überarbeitung und Fortschreibung bestehender Regelwerke und Normen. Rohstoff- und Kreislaufwirtschaftsstrategie werden so eng verzahnt.

Zur Finanzierung von Rohstoffvorhaben im Ausland hat die Bundesregierung ihr Garantieprogramm für ungebundene Finanzkredite (UFK) ausgebaut. Mit dem sog. Klima-UFK können nun neben reinen Rohstoffvorhaben auch Projekte für Vor- oder Verarbeitungsprodukte (z. B. Batteriezellen, H2 und dessen Derivate) unterstützt und so die Versorgung mit diesen für die deutsche Industrie wichtigen Produkten befördert werden.

Die Bundesregierung unterstützt weiterhin die EU-Initiativen im Rahmen des Green Deals wie den EU-Aktionsplan Kreislaufwirtschaft, in dem die Europäische Kommission durch nachhaltigere Produktionsprozesse, langlebigere Produkte und Recycling einen nachhaltigeren Umgang mit Ressourcen fördern will. Darunter u. a. die EU-Ökodesignverordnung oder den zuvor erwähnten Critical Raw Material Act, mit dem u. a. Recycling und Kreislaufwirtschaft einen stärkeren Beitrag zur Rohstoffsicherung insbesondere auch im Hinblick auf strategische und kritische Rohstoffe leisten sollen (z. B. für seltene Erden). Hier setzen wir uns u. a. dafür ein, dass der Ansatz der Kreislaufwirtschaft noch stärker betont wird.

2.3 Erneuern, was uns stark macht

Es gilt jetzt, die Kraft unseres Landes als Kraft der zukunftsfesten Erneuerung unseres Standorts einzusetzen. Den Industriestandort zu sichern bedeutet, die industrielle Basis zu erhalten, die uns zu einem starken Industrieland macht. Die deutsche Industrie ist das Herzstück komplexer Wertschöpfungsketten, die sich durch ganz Europa ziehen und an denen Millionen Arbeitsplätze hängen. Das gilt für die gesamte Produktpalette der deutschen Industrie von Grundstoffen über Zwischenprodukte bis hin zu Endprodukten. Diese Breite und Vielfalt wollen wir erhalten und Wertschöpfungsketten sichern – weil an ihnen unser Wohlstand hängt und weil sie unserer Wirtschaftssicherheit dienen.

Dafür gilt es, die erfolgreichen Geschäftsmodelle der deutschen Industrie so weiterzuentwickeln, dass sie klimaneutral und dabei auch in Zukunft global wettbewerbsfähig sind. Zentraler Baustein ist dabei die vollständige Umstellung auf klimaneutrale Produktionsweisen in allen Sektoren. Dabei ist unser Anspruch klar: Die Transformation soll hier in Deutschland stattfinden. Die klimaneutralen Produkte und Herstellungsprozesse der Zukunft sollen hier entwickelt und zur Anwendung gebracht werden. Damit Wertschöpfungsketten intakt bleiben, Versorgungssicherheit gewahrt und gestärkt wird und gute Arbeitsplätze erhalten bleiben – und Deutschland auch in Zukunft in zentralen Bereichen die Technologieführerschaft innehat und Produkte Made in Germany auf der ganzen Welt gefragt sind.

Diese Umstellung ist eine große Herausforderung. Sie kostet die Unternehmen Kraft und Geld, weil sie in neue Produktionsanlagen investieren und ihre Beschäftigten umschulen müssen. Sie ist aber auch eine große Chance: Auf den Märkten der Zukunft werden die Unternehmen erfolgreich sein, die den Übergang zur Klimaneutralität am schnellsten und besten bewerkstelligen werden.

Die Verantwortung für die Erneuerung unserer industriellen Wertschöpfung liegt in erster Linie bei den Unternehmen und ihren Beschäftigten. Viele haben sich schon auf den Weg gemacht und für die Zukunft aufgestellt. Doch auch dem Staat kommt eine entscheidende Rolle zu: Indem er den richtigen Rahmen setzt und die Unternehmen mit

gezielter Förderung bei der Umstellung ihrer Produktion unterstützt. Dafür hat die Bundesregierung in den letzten 21 Monaten ein großes Bündel an Maßnahmen auf den Weg gebracht und weitere Schritte stehen unmittelbar bevor.

Mit ihr stellen wir nicht nur unseren Wohlstand auf neue Füße – mit der Dekarbonisierung unserer Industrie kommen wir auch unseren internationalen Verpflichtungen nach dem Pariser Klimaabkommen nach. Dabei müssen einerseits vielfach Produktionsverfahren grundlegend geändert werden, um Treibhausgasemissionen zu vermeiden. Das gilt beispielsweise, wenn eine Glasproduktion von Erdgas auf Strom und Wasserstoff oder ein Stahlwerk von Kohle auf Wasserstoff umgestellt wird. Es gilt auch, wenn ein Chemiewerk eine andere Kohlenstoffquelle als fossiles Erdgas oder Erdöl erschließt. Diese Herausforderung betrifft vor allem die energieintensive Industrie. Ihr begegnen wir mit einem breiten Instrumentenmix – angefangen vom ETS als Leitinstrument bis zu Förderprogrammen wie den Klimaschutzverträgen.

Anderseits müssen einige Industrien ihre Produktpalette komplett umstellen, weil die Produkte selbst bei ihrer Anwendung nicht klimaneutral sind. Dies betrifft nicht nur, aber insbesondere den Fahrzeugbau.

Diese Transformation in der Industrie ist ökonomisch herausfordernd: Die neuen, klimafreundlichen Technologien sind derzeit noch oft deutlich teurer als die konventionellen, klimaschädlichen Verfahren. Klimaschutz in der Industrie braucht entschlossenes Handeln der Industrie und ihrer Beschäftigten. Der Staat muss ihnen dabei Planungssicherheit durch einen klaren Transformationspfad geben und Wettbewerbsnachteile ausgleichen.

a) ETS als Leitinstrument

Überbau für unser staatliches Handeln in Deutschland ist der Europäische Green Deal, der sich in die europäischen Klimaschutzinstrumente übersetzt. Der europäische Emissionshandel (Emissions Trading System, ETS) ist das Leitinstrument auf dem Weg zur Klimaneutralität. Im ETS werden die hohen Schadenskosten des Klimawandels zumindest teilweise internalisiert und Unternehmen bekommen ein unverfälschtes Preissignal: Mit ansteigenden CO_2-Preisen werden CO_2-Emissionen teurer und die Nutzung Erneuerbarer Energien wird im Verhältnis zu fossilen Energien günstiger. Dieses Instrument schafft also einen marktbasierten, ökonomisch effizienten Anreiz zum Umstieg auf klimafreundliche Technologien und für eine effizientere Energie- sowie Ressourcennutzung.

Die EU ist mit dem Emissionshandelssystem weltweit Vorreiter. Zwar haben auch andere Staaten Formen der CO_2-Bepreisung eingeführt – allerdings bleibt dies in großen Staaten wie etwa den USA absehbar aus. Solange in diesen Ländern der Ausstoß von CO_2 die betreffenden Unternehmen nichts oder nur wenig kostet, ergeben sich Wettbewerbsnachteile für unsere Unternehmen. Diese Wettbewerbsverzerrung durch unterschiedliche Ambitionen bei der Klimapolitik kann dazu führen, dass Unternehmen ihre CO_2-intensive Produktion in andere Länder ohne CO_2-Bepreisung verlagern und die Emissionen dort steigen (sog. Carbon Leakage). Damit wäre weder der europäischen Wirtschaft noch dem weltweiten Klimaschutz geholfen.

Deswegen tritt ab Herbst 2023 schrittweise der EU-weite CO_2-Grenzausgleichsmechanismus (engl. Carbon Border Adjustment Mechanism, CBAM) in Kraft. Importe von emissionsintensiven Produkten aus Ländern, in denen keine vergleichbare CO_2-

Bepreisung besteht und die daher günstiger produziert werden konnten, werden ab 2026 mit einem CO_2-Aufschlag belegt. Damit bekommen die CO_2-Emissionen bestimmter energieintensiver Produkte, die in die EU importiert werden, einen Preis.

Der ETS hat die Elektrifizierung und Energieeffizienz in der Industrie schon stark vorangetrieben. Er setzt aber vielfach noch keinen ausreichenden Anreiz für den notwendigen nächsten Schritt: Produktionsverfahren müssen grundlegend umgestellt werden, zum Beispiel durch den Einsatz von Wasserstoff oder CCS/CCU, damit sie mit dem Ziel der Klimaneutralität kompatibel sind. Dadurch droht Investitionsattentismus: In klimaschädliche Herstellungsverfahren wollen Unternehmen nicht mehr investieren, aber die Investition in neue Verfahren lohnt noch nicht; das ist einerseits ein Problem, weil vielfach jetzt große Erneuerungszyklen anstehen, und anderseits, weil neue Herstellungsverfahren jetzt auf industrieller Skala erprobt werden müssen, damit sie rechtzeitig für die breite Anwendung zur Verfügung stehen.

b) Förderprogramme

CO_2-Bepreisung und CO_2-Grenzausgleichsmechanismus haben wir daher um einen dritten Bereich ergänzt: die staatlichen Förderprogramme. Durch sie ermöglichen wir eine Transformation der Industrie in der Schnelligkeit und Tiefe, wie dies für die Erneuerung unseres Industriestandorts und seine langfristige Wettbewerbsfähigkeit bei gleichzeitiger Einhaltung unserer Klimaziele erforderlich ist. Wir ermöglichen, dass Unternehmen in Deutschland neue Industrieanlagen für den weltweiten Markt entwickeln, bauen und betreiben; Anlagenbauer entwickeln neue Produkte für klimafreundliche Anwendungen, nach denen auf dem Weltmarkt zunehmende Nachfrage entstehen dürfte. So können ganz neue Wertschöpfungsketten in Deutschland entstehen, etwa von der Wasserstoff-Produktion bis hin zum Verkauf klimaneutral hergestellter Elektroautos. Dadurch werden Stärken in Bereichen gefestigt, in denen die deutsche Industrie schon heute stark ist, und wir gewinnen Marktanteile auf neuen Märkten.

Ziel der Förderprogramme kann und darf es dabei nicht sein, sämtliche Mehrkosten aller Unternehmen zu erstatten, die durch die Transformation zur Klimaneutralität entstehen. Ziel unserer Industriepolitik ist vielmehr, die Markttransformation anzustoßen. Sobald diese Markttransformation in Gang gekommen ist, sinken die Mehrkosten für klimafreundliche Industrieproduktion und damit auch der Bedarf an staatlicher Förderung.

Ein zentrales Instrument ist hier das Förderprogramm Klimaschutzverträge (KSV), das die Bundesregierung nach ihrem Amtsantritt neu aufgelegt hat und für das ein mittlerer zweistelliger Milliardenbetrag zur Verfügung steht. Klimaschutzverträge (engl. Carbon Contracts for Difference, CCfD) ermöglichen es Industrieunternehmen, in klimafreundliche Produktionsanlagen zu investieren, die sich andernfalls noch nicht rechnen würden (z. B. in der Zement-, Papier-, Stahl- oder Glasindustrie). Zwei Eigenschaften machen das Förderprogramm besonders effektiv. Erstens wird eine variable Förderung gezahlt, die sich nach den aktuellen CO_2-Preisen des ETS und den aktuellen Energiepreisen bemisst. Wenn die klimafreundliche Produktion günstiger wird als die konventionelle, kehrt sich die Zahlung um: Die geförderten Unternehmen zahlen sodann Mehreinnahmen an den Staat. Zweitens erfolgt die Vergabe durch ein Auktionsverfahren: Unternehmen müssen bieten, wie viel staatliche Unterstützung sie benötigen, um mit ihrer transformativen Technologie eine Tonne CO_2 zu vermeiden. Dadurch erhalten diejenigen Unternehmen den Zuschlag für einen Klimaschutzver-

trag, die am günstigsten ihre Produktion umstellen. Im Gegenzug entfallen die üblichen Dokumentations- und Nachprüfpflichten, die zu einer hohen Belastung von Unternehmen und zu aufwändigen Bewilligungsverfahren geführt haben. Das BMWK hat die neue Förderrichtlinie zu den Klimaschutzverträgen so ausgestaltet, dass sie auch dem emissionsintensiven Mittelstand offenstehen: Die konventionelle Produktionsanlage, die als Referenz herangezogen wird, muss nur 10 Kilotonnen CO_2 pro Jahr ausstoßen. Zudem können sich mehrere Betreiber mit kleineren Anlagen als Konsortium zusammenschließen.

Das im Sommer 2023 durchgeführte vorbereitende Verfahren hat unsere Erwartungen bei Weitem übertroffen und gezeigt: Industrieunternehmen in Deutschland stehen mit hochinnovativen Projekten in den Startlöchern, um mit neuartiger Technologie ihre Fabrikationsprozesse auf Klimaneutralität umzustellen. Viele andere Länder und auch die EU-Kommission bereiten nun vergleichbare Instrumente vor. Wir sind in Deutschland als erstes Land bereit und möchten die erste Gebotsrunde noch 2023 starten.

Weitere Unterstützung beim Bau von innovativen Projekten, die zur Klimaneutralität beitragen, bietet das IPCEI Wasserstoff. Zwei wichtige Leuchtturmprojekte sind die Stahlwerke von Thyssenkrupp und von der Salzgitter AG. Gemeinsam mit den Bundesländern Nordrhein-Westfalen und Niedersachsen fördern wir in Duisburg und Salzgitter den Einstieg in die Herstellung von grünem Stahl und helfen so bei der Erschließung einer Schlüsseltechnologie für den Klimaschutz. Zudem unterstützen wir mit dem Programm Dekarbonisierung in der Industrie Musterprojekte von der Chemieindustrie über Glas-, Stahl- und Zementindustrie. In den nächsten Jahren sollen für diese und weitere Projekte mehr als 500 Mio. Euro ausgeschüttet werden. Das Programm überarbeiten wir aktuell auch, um noch mehr innovative Projekte fördern zu können.

Nicht immer geht es aber um große Neuinvestitionen. Deutschlands Industrie ist geprägt durch den industriellen Mittelstand. Hier leisten bereits heute viele Betriebe einen wichtigen Beitrag zur klimaneutralen Erneuerung unseres Industriestandorts. Um gerade mittelständische Betriebe frühzeitig fit zu machen und in ihren Transformationsbemühungen zu begleiten, werden diese gezielt unterstützt. Die Investitionsprämie für Transformationstechnologien im Wachstumschancengesetz begünstigt Maßnahmen zur Steigerung der Energieeffizienz steuerlich direkt um 15 Prozent. Mit der Bundesförderung für Energie- und Ressourceneffizienz in der Wirtschaft (EEW) stellen wir jährlich über 800 Mio. Euro für Maßnahmen der Energieeffizienz, Ressourceneffizienz und Technologiewechsel zur Verfügung.

Auch im Bereich der Außenwirtschaftsförderung hat die Bundesregierung Anpassungen vorgenommen, um deutsche Exporteure und Investoren auf – mit Blick auf den Klimawandel häufig sehr vulnerablen – Zielmärkten zu begleiten. So sind die Garantieinstrumente des Bundes zur Außenwirtschaftsförderung durch die neue Klimastrategie mit ihren Sektorleitlinien nun auf einen Net-Zero-Pfad bis 2050 ausgerichtet. Durch bessere Förderkonditionen werden im Einklang mit dem 1,5-Grad-Ziel stehende Exporte und Investitionen angereizt und durch Absicherung gegen wirtschaftliche und politische Risiken der Auslandsgeschäfte unterstützt.

c) Grüne Leitmärkte

So wichtig unsere Förderprogramme zum aktuellen Zeitpunkt für den Klimaschutz und den Industriestandort Deutschland sind, so sehr müssen wir

daran arbeiten, dass diese mittelfristig überflüssig werden. Eine klimafreundliche Industrie muss sich nicht nur wie heute in einigen, sondern in allen Bereichen auch ohne staatliche Förderung lohnen. Die CO_2-Bepreisung und der CO_2-Grenzausgleichsmechanismus sind dafür zentral. Ein weiteres Instrument soll diese Bemühungen abrunden: Die Schaffung grüner Leitmärkte für Grundstoffe wie z. B. Stahl, Zement und Ammoniak, sodass Unternehmen ihre klimafreundlich hergestellten Produkte zu einem höheren Preis (durch sog. grüne Premium) verkaufen können. Wir definieren dafür gemeinsam mit den Stakeholdern in einem ersten Schritt die Anforderungen an die klimafreundliche Produktion, nach der die Grundstoffe als klimafreundlich angesehen werden. Die Ergebnisse werden wir noch dieses Jahr vorstellen. Als zweiten Schritt prüfen wir die Einführung von freiwilligen Kennzeichnungen (etwa ein Label). Unternehmen könnten ihre klimafreundlich hergestellten Produkte dann standardisiert bezeichnen und bewerben.

Gleichzeitig wollen wir die Attraktivität klimafreundlicher Produkte dadurch steigern, dass wir uns als Staat verpflichten, bei der öffentlichen Beschaffung klimafreundliche Produkte zu bevorzugen. Spätestens ab 2045 in Deutschland und ab 2050 in Europa werden klimafreundliche Produkte so der Standard sein. Die Leitmärkte könnten in Deutschland aber nicht entstehen, wenn es nicht zunächst einige Unternehmen gibt, die klimafreundliche Produkte herstellen und mit ihrer dadurch gewonnenen Expertise bei der Definition der Anforderungen sowie der Etablierung erster Wertschöpfungsketten mithelfen. Deswegen ist für die Etablierung grüner Leitmärkte zunächst eine Initialförderung unabdingbar. Mittelfristig steigen durch die grünen Leitmärkte aber die Erlöse für grüne Produkte, sodass der Förderbedarf sinkt.

d) CCS/CCU

Schließlich müssen wir für die klimaneutrale Erneuerung unserer Industrie auch neue Technologien erschließen: Laut Weltklimarat IPCC gehört zu den notwendigen Klimaschutztechnologien die Abscheidung und Speicherung bzw. Nutzung von Kohlenstoffdioxid (CCS bzw. CCU). Auch Deutschland wird seine Klimaneutralitätsziele nur erreichen können, wenn es auch CCS/CCU nutzt. Die Nutzung von CCS ist dabei in erster Linie für die Bereiche notwendig, in denen es kaum oder keine technologischen Möglichkeiten der Einsparung gibt.

Nach jahrzehntelanger Forschung und Erprobung wird die Technologie in einigen EU-Ländern (vor allem Nordseeanrainer) und in Industriestaaten außerhalb Europas verlässlich und sicher und z. T. bereits im industriellen Umfang angewandt. Norwegen betreibt zwei großskalige Speicherstätten für CO_2. Dänemark, die Niederlande und das Vereinigte Königreich haben mit der Erschließung von Speicherstätten für CO_2 und dem Aufbau industrieller Anwendungen begonnen. Auch in den USA und in Kanada bestehen seit Jahrzehnten Erfahrungen mit der CCS-Technologie. Auf europäischer Ebene regelt bereits seit 2009 eine Richtlinie die sichere und umweltverträgliche Anwendung von CCS/CCU. Eine Reihe von europäischen Förderinstrumenten zur Dekarbonisierung der Industrie haben das Ziel, die Technologie breiter zur industriellen Anwendung zu bringen. Mit dem kürzlich vorgelegten Vorschlag der EU-Kommission zum Net Zero Industry Act sollen europaweit weitere Impulse in den Ausbau der Transport- und Speicherinfrastruktur für CO_2 gelegt werden.

Daher wird die Bundesregierung eine Carbon Management-Strategie vorlegen, die die Anwen-

dung von CCS und CCU ermöglichen und punktuell fördern wird. Dies bedeutet auch, die entsprechenden Transport-Infrastrukturen in Deutschland zu errichten und gemeinsam mit den europäischen Partnern eine gemeinsame Speicherstrategie zu finden.

e) Mobilitätsindustrie

Besonderes Augenmerk bei der klimaneutralen Erneuerung unserer Industrie gilt der beschäftigungs- und umsatzstärksten Branche in Deutschland: dem deutschen Fahrzeugbau, insbesondere also der Automobilindustrie und ihren Zulieferern.

Die Transformation in der Automobilindustrie ist derzeit in vollem Gange und der internationale Wettbewerbsdruck nimmt zu. In den USA und in China sind neue Wettbewerber gerade im Bereich der E-Mobilität entstanden.

Im Pkw-Bereich ist absehbar, dass die zukünftige Leittechnologie das batterieelektrische Fahrzeug ist – auch wenn daneben weitere Technologien am Markt bestehen bleiben. Die absehbaren weiteren Innovationsdynamiken in der Batterietechnologie und die perspektivisch günstigen Stromkosten durch Erneuerbare werden die Marktdynamiken beherrschen. Deshalb ist es von entscheidender Bedeutung, dass die deutsche Automobilindustrie hier im Wettbewerb vorne mitspielt. Die Bundesregierung unterstützt die Industrie dabei entschlossen. Gemeinsam mit Industrie und Gewerkschaften haben wir das strategische Ziel von 15 Millionen rein batterieelektrischen Pkw (BEV) im Fahrzeugbestand bis 2030 ausgerufen. Dieses Ziel hat nicht nur eine klimapolitische Bedeutung. Gleichzeitig wollen wir, dass dieses Ziel Investitionen in die Elektromobilität auf dem Heimatmarkt stärkt und automobile Wertschöpfung in Deutschland sichert. Und tatsächlich ist Deutschland in Europa, aber auch im internationalen Vergleich ein Markt, in dem die Elektromobilität bereits heute hohe Marktanteile erreicht hat. Trotzdem muss noch mehr getan werden, um unser strategisches Ziel zu erreichen. Das BMWK wird den Hochlauf der Elektromobilität weiter eng begleiten und wenn nötig zusätzliche Maßnahmen vorschlagen.

Das BMWK unterstützt die Automobilindustrie beim Wandel hin zu den Technologien der Mobilität der Zukunft allein von 2023 bis 2026 mit über sechs Milliarden Euro. Darunter fallen u. a. das Zukunftsinvestitionsprogramm für Fahrzeughersteller und -zulieferer, die Förderung regionaler Transformationsnetzwerke und Transformations-Hubs, das Forschungsprogramm „Neue Fahrzeug- und Systemtechnologien“ sowie das Förderprogramm Elektro-Mobil. Die Programme adressieren bspw. die Umstellung der Produktion hin zu elektrischen Fahrzeugen, den Aufbau eines europäischen Batterieökosystems und den Aufbau von Kompetenzen in der Digitalisierung der Fahrzeuge sowie der Produktion. Es entstehen neue Produktionskapazitäten entlang der Wertschöpfungskette in Deutschland, darunter das Kathodenwerk von BASF in Schwarzheide und die geplante Batteriefabrik von Northvolt in Heide. Entscheidend für die Elektrifizierung des Verkehrs ist auch der beschleunigte Ausbau einer flächendeckenden und bedarfsgerechten Ladeinfrastruktur. Ziel der Bundesregierung sind eine Million öffentlich und diskriminierungsfrei zugängliche Ladepunkte bis 2030. Der Fokus liegt auf der Schnellladeinfrastruktur. Ein Standortvorteil Deutschlands war immer das automobile Ökosystem mit den Automobilherstellern, den großen und kleinen Zulieferern, Forschungsinstituten, Universitäten und Hochschulen und gut ausgebildeten Beschäftigten. Dieses Ökosystem gilt es, durch die Transformation der Automobilwirtschaft hinweg aufrechtzuerhalten und zukunftsfähig weiterzuentwickeln.

Auch andere Bereiche des Fahrzeugbaus stecken mitten in der Transformation. Die industrielle Stärke der deutschen Luftfahrtindustrie wollen wir erhalten und zugleich den technologisch höchst anspruchsvollen Schritt zur Klimaneutralität wagen. Das Flugzeug der nächsten und übernächsten Generation muss nicht nur nochmals deutlich effizienter sein, sondern z. B. durch den Einsatz von Wasserstoff auch in der Lage sein, den Luftverkehr perspektivisch gänzlich zu dekarbonisieren. Die Bundesregierung unterstützt die Luftfahrtindustrie auf ihrem technologischen Transformationspfad aktiv, z. B. mit Forschungsförderung in Höhe von aktuell 465 Mio. Euro pro Jahr aus dem Luftfahrtforschungsprogramm LuFo Klima.

Die maritime Wirtschaft gehört mit einem jährlichen Umsatzvolumen von rund 50 Milliarden Euro und bis zu 400.000 Arbeitsplätzen zu einem der wichtigsten Wirtschaftszweige in Deutschland. Das BMWK unterstützt Forschungs- und Entwicklungsprojekte der Schiffbau- und Zulieferindustrie mit dem Maritimen Forschungsprogramm in den Bereichen Schiffstechnik, Schifffahrt, Meerestechnik und der maritimen Produktion mit jährlich rund 90 Mio. Euro. Für den beschleunigten Ausbau der Offshore-Windenergie werden deutsche Werften künftig eine Schlüsselrolle spielen. Sie werden als Produktionsstandorte für die neue Generation von 2-GW-Konverterplattformen dringend benötigt, die für eine Anbindung der Offshore-Windparks zwingend erforderlich sind.

Die Bahnindustrie in Deutschland deckt mit einem Umsatz von mehr als 12 Milliarden Euro und gut 53.000 direkt Beschäftigten das gesamte Spektrum von der Entwicklung und Fertigung von Systemen und Komponenten für Schienenfahrzeuge und Infrastruktur sowie Signaltechnik und Serviceleistungen ab. Weltweit führende Systemhäuser arbeiten dabei Hand in Hand mit einer international breit aufgestellten, mittelständisch strukturierten Zuliefer- und Systemindustrie, den Hidden Champions der Bahnindustrie. Die Branche leistet einen wichtigen Beitrag zu einer nachhaltigen Mobilität, sowohl im Personen- als auch im Güterverkehr.

E. Ausblick

Diese Industriestrategie des BMWK ist ein Beitrag dazu, die Industriepolitik der Bundesregierung zu erklären und ihren größeren strategischen Zusammenhang sowie ihre Einbettung in die soziale Marktwirtschaft zu beschreiben. Sie ist zugleich ein Impuls zur Zukunft unseres Industriestandorts und was wir für ihn tun müssen.

Erster Meilenstein in dieser Debatte ist die Industriekonferenz des BMWK am 31.10.2023, auf der wir die Strategie breit im Bündnis Zukunft der Industrie mit Verbänden und Gewerkschaften sowie mit Vertretern aus der Politik aus Deutschland, Europa und unseren Verbündeten weltweit diskutieren möchten.

Die verbleibenden zwei Jahre dieser Legislaturperiode müssen wir dafür nutzen, die schon auf den Weg gebrachten Maßnahmen umzusetzen und bei den wichtigen offenen Fragen wie dem Brückenstrompreis schnelle und tragfähige Einigungen zu erzielen.

Doch eine Industriestrategie kann nicht den Horizont einer Legislaturperiode haben – die Umsetzung dieser Strategie zur Sicherung des Industriestandorts, zur Erneuerung unseres Wohlstands und zur Stärkung unserer Wirtschaftssicherheit ist die Aufgabe für die Politik für das gesamte vor uns liegende Brückenjahrzehnt.

Dafür braucht es gemeinsam volle Kraft und einen langen Atem. Es lohnt sich – für ein starkes Industrieland Deutschland.

Stainless steel life cycle

outokumpu.com/en/sustainability/environment/circular-economy/stainless-steel-life-cycle

Stainless steel fits perfectly into circular economy. Recycling saves resources, and stainless steel is both made of recycled materials and fully recyclable, without any quality degradation. Durability is also important from the life-cycle point of view. Using Outokumpu's stainless steel can help to decrease your carbon footprint and that of your customer.

A life-cycle analysis shows the environmental impact of a product over its whole life cycle. Stainless steel strengths are visible especially from the life cycle point of view. Generally, material properties enable lower life cycle costs combined with lower environmental impact.

Recycling and durability

Our most important raw materials are recycled stainless and carbon steels. Recycling a product saves resources by reducing the need to extract new minerals and ores from the ground. The average recycled material content for all stainless produced by Outokumpu is over 90%, the highest on the market. In 2022, we reached an all-time high recycled

material content rate of 94%, incl. steel scrap and waste streams from our production. In comparison, a recent study by the Yale University showed that the global average of recycled content is only 44%.

However, durability is also important. Manufacturing something only once, instead of twice or even three times during a certain time period, due to breakdowns and repair, is of course less resource consuming. Stainless steel helps to prolong the lifetimes of applications, for example bridges susceptible to corrosion, or components like exhaust pipe systems in cars.

A study by Boston Consulting Group on the CO_2 emissions related to the six relevant uses of steel revealed that CO_2 savings in the use phase are six times the CO_2 needed to produce the steel.

Low life-cycle costs for stainless steel

The durability of stainless steel also has a cost-effective impact from a life-cycle perspective. Stainless steel requires only minimal maintenance, which is both economical and good for the environment and society. The combination of corrosion resistance and durability increases product lifetime. In certain cases, these cost savings can be in the range of 30% to 40% compared to alternative materials, and they arise from reduced repair and maintenance costs.

Overall life-cycle impact of our products

The strengths of Outokumpu’s stainless steel are especially visible from a life cycle perspective. By paying more attention to life cycle oriented environmental management and conducting several life cycle inventory studies we have been able to point out and act on the most efficient ways to reduce the overall life cycle impact of our products.

The use of Outokumpu's steel in modern society minimizes emissions by creating efficiency in, for example, transport, construction and energy production. Thus, Outokumpu’s stainless steel supports prosperity and health. Other means of, and our strengths in, reducing our environmental impact are:

- Efficiency in energy use
- Choice of electricity sources
- Material efficiency in production

In **energy efficiency**, Outokumpu is taking a long-term approach: the target is a continuous improvement of a 0.5% reduction yearly.

In choosing **electricity sources**, Outokumpu participates in low-carbon electricity production, such as new power plant projects, and enters into agreements with parties in the power market, contributing to the future construction of adequate power production capacity.

Improving resource efficiency is the most effective measure Outokumpu has to directly reduce the environmental impacts of steel production. Outokumpu aims to have a steel production system where all the materials resulting from production are fully utilized and manufacturing processes have been developed to facilitate this. For instance, Outokumpu is able to utilize its own ferrochrome which further strengthen our footprint: our ferrochrome process is efficient and since we operate the only chrome mine in Europe close by the Tornio mill, the impact of the transport is minimized.

End of the life cycle

"End of Life" describes the phase in a product or solution's life cycle where its active usage comes to an end. What happens during the "end of life" is significant in terms of environmental efficiency. Stainless steel can be recycled infinitely - and it suffers no quality degradation during reprocessing.

Recycled stainless steel is valuable material and the recycled steel market is a viable large scale business. Environmental and sustainability benefits of recycling, such as conservation of non renewable resources, saving energy, avoiding emissions and reducing waste, affect an entire society's sustainability.

The end of life recycling rate for stainless steel is over 80% on average. Since stainless steel is used in a wide range of sectors, from architecture, building and construction and also in industrial machinery where the average rate is over 90% recycled, to sectors where the recycling rate is only some 60%. By these sectoral rates, also known as recovery ratios, stainless steel industry follows the overall recycling efficiency. One way of improving a product's sustainability is to make an effort during the product design phase in order to aid efficient recycling at the end of active usage phase.

Stainless steel has valuable metal content - chromium and nickel. Markets for recycled stainless steel are functioning without any stimulus and the stainless steel industry is utilizing all feasibly available recycled stainless steel. All Outokumpu production sites use recycled material as main raw material. However, there is not enough recycled steel containing nickel and chromium on the market to satisfy the demand for production of new stainless steel. This means that stainless steel made today is recycled multiple times and the virgin ore such as chromium and other alloys added during production will remain in stainless steel stock actively used by society. Disposal of stainless steel waste to landfills is not harmful to the environment, but is a waste of resources.

aperam

Sustainability Report 2022

Sustainable by Design
Made for Life

External Assurance

We declare this report with reference to Global Reporting Initiative 2021.

Material aspects and indicators are shown on p.13. Detailed Disclosures on Management Approach (DMA) can be found in the online supplement 'C'. The scope of the information and data in this report covers global operations from January to December 2021.

Aperam's production capacity is focused on:
> 6 production sites in Brazil (Timóteo), Belgium (Châtelet, Genk), and France (Gueugnon, Imphy, Isbergues/Recyco),
> 15 Steel Service Centers (SSC), part of our Services & Solutions segment,
> 11 transformation facilities: 5 in the Services & Solutions segment; Pont de Roide in the Stainless & Electrical Steel segment, BioEnergia in the Aperam Aperam Recycling & Renewables segment; and Rescal, Amilly, Imhua and ICS in Alloys & Specialties,
> 51 scrap yard sites in North America, Europe, Asia, Australia and South Africa, for the trading, processing and recycling of secondary raw materials within the Aperam Recycling (former ELG) segment,
> 15 sales offices for the Services & Solutions segment,
> Registered office: 24-26 Boulevard d'Avranches, L-1160 Luxembourg.

The report does not cover any joint venture operations or activities of or with partner organisations.
- Safety data covers Services & Solutions and Alloys & Specialties, as well as on-site contractors.
- Human resources data exclude contractors.
- Subject to the exclusions indicated below, environmental data covers all the main industrial sites, SSCs and corporate offices.

Environmental information is compiled locally and aggregated centrally. The CO_2 emissions data relates to Scopes 1 and 2, unless otherwise mentioned.
The following exclusions apply to the environmental data:
(1) Raw material data excludes packaging and miscellaneous parts ;
(2) Scope 3 indirect emissions (partial estimates).

This report represents our Communication on Progress relating to United Nations Global Compact (UNGC) membership (see Supplement 'A').

Caveat

On Dec. 27, 2021, Aperam completed the acquisition of ELG, a global leader in stainless steel and superalloys recycling, with the aim to further strengthen Aperam's competitiveness and Sustainability leadership position in the industry.

ELG is fully consolidated into the Aperam Group from that date as part of the new Recycling & Renewables Division, unless otherwise mentioned.

Independent Assurance Statement

The 'Made for Life' report is a component (the 'summary') of our complete sustainability reporting (the 'Report') for the year ending 31 December 2022

The Report is composed of five items: the 'Made for Life Report' and four Supplements – A, B, C and D. Our 2022 Report can be found on our website (www.aperam.com/sustainability), together with the four supplements. The summary report has been prepared "with reference to the GRI Standards".
The summary should be read with its accompanying Supplements to constitute the complete Report.

PricewaterhouseCoopers, Société Coopérative (PwC) has been engaged to carry out a limited assurance engagement under International Standard on Assurance Engagements ("ISAE") 3000 to issue an assurance report in respect of certain information disclosed in the "Made for Life" 2022 (the "Sustainability Report") as set out in the table of the Scope section (the "Selected Information Table") of the opinion (p. 69) in accordance with certain Assessment Criteria.
These Assessment Criteria have been derived from certain sections of the Global Reporting Initiative (« GRI ») framework and by applying additional methodology defined by company policies that management considers as relevant for the purpose of the Company's business and for the ultimate users of the "Made for life" 2022 (refer to Supplements Online for more details).

Selected performance data is marked in the Report with a '*':

Contents

About Aperam

Opening words From our Chief Executive Officer.

Company profile A global leader in Stainless and Specialty Steel serving multiple markets ; Our Offering ; Our Main Sites.

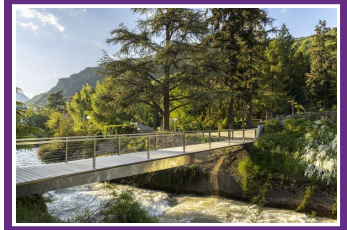
Business Model: Sustainability is fully embedded within our Business operations.

Sustainability strategy: How Aperam's roadmap and reporting comply with GRI principles.

Social: Our People

With safety as our top priority, Aperam aims to be a sustainable and profitable company with our efficient and passionate workforce as our main asset.

> See how our approach ensures the safety, development and well-being of our people, even in COVID times.



Environment: Our Planet

As part of an energy-intensive industry consuming metallic ores and other raw materials, Aperam takes environmental stewardship seriously.

> Read about the many ways we are becoming a more sustainable company by reducing our industrial footprint and working to raise awareness about important environmental issues.

Governance: Our Stakeholders

From the support of our subcontractors on-site to the strong partnerships built with our suppliers and customers and up to local infrastructures - our success is dependent on the communities we operate in. Our Corporate Governance is based on the highest standards and complies with the most rigorous business ethics. As a member of the ResponsibleSteel™ initiative, we are committed to taking stakeholder engagement and responsibility to a new level.

> See how we continually strive to develop in a way that benefits the public at large.

About this Report

GRI Index and Disclosures on Management Approach

Methodology Supplements: United Nations' Global Compact reference; Materiality Process at Aperam; GRI Index/Disclosures on Management Approach.

Country Supplements: For stakeholders and available in the local languages of our three main countries of operation (Belgium, Brazil, France) - to be released later.

About Aperam

Opening Words from our CEO

While 2022 started off promising, Russia's war with Ukraine changed everything. Not only has this war brought unbearable human suffering, it's also impacted the global economy, causing the biggest energy crisis in decades and peak inflation rates. In this context, Aperam has acted with great determination to cushion the impact of these challenges.

Putting human factors at the centre of our concerns has long been our credo, but in this context, it resonates even deeper. That's why we worked to fully integrate our former ELG-colleagues into the Aperam family and to ensure our approximately 10,700 highly committed employees worldwide have access to a stable future.

Considering the cascade of crises we've faced the last several years, business as usual now means being prepared for the unusual. At Aperam, this means having a strong ability to quickly adapt to the highly disruptive and volatile environment without losing focus on the long term challenges. In 2022, our teams were committed and focused on pursuing the design and deployment of a thoughtful roadmap to transform our processes and operations. This enabled us to respond quickly to the ultimatum poised by the energy transition, the climate crisis, inflation and societal challenges. It also serves the increasing needs of our customers for high quality and added-value products and solutions.

As a matter of fact, our social, environmental and societal responsibilities will never be pushed into the background. Aperam will always navigate the future with these three pillars as our compass, our strength and our pride.
While this Sustainability Report contains details about the steps we took in 2022 as part of our journey, here I'd like to note several highlights.

▶ Like always, Aperam puts people and their health and safety first.

That is why, even with our good Health & Safety results overall, with our LTFR at 2.4 and our TRIR at 7.1 (stable versus 2021), and the award granted by the ISSF on our JustCulture program, I cannot be satisfied with a year darkened by a fatality, one of a subcontractor performing roof maintenance in Brazil. As we consider our partners as our own personnel, we performed a full audit and review of all our processes for this type of external work to prevent such a tragedy from happening again.
I remain convinced that our roadmap, which is both strong and comprehensive, will bring us to the next level of Health & Safety performance. For instance, we work hard to create a company culture where we care for each other and learn from our mistakes - work that can be seen in the 2022 roll-out of a global training on the topic. Our commitment remains unchanged and we believe we can outperform the industry average. For this reason, we made H&S a hard target in the ESG-bond financing[1] concluded in February 2022.

Another challenge was to adapt to the low demand in the second semester in Europe, notably through economic unemployment at some of our plants, and, in South America, the closure of our Uruguay Tube unit. However, it was also during this period that we achieved the sound integration of our Aperam Recycling Division. This report demonstrates the extremely promising progress we made, with many of our new colleagues starting to see the benefits of cooperation, in particular on such topics as Health & Safety. We've also seen some 'cross pollination' happening, with former Aperam people joining the new Division and former ELG employees bringing fresh views to our steel business.
For the first time, in 2022, our annual Employee Climate Survey included our new Aperam Recycling colleagues. It also recorded a global response rate of 77%. This study is strategic as it guides many of our programs. For example, it confirmed some of our strengths, in particular our workforce's adherence to our H&S program as well as our past efforts to improve diversity, and this motivated us to go even further and include a specific focus on disability and several initiatives relating to mental health. Some areas for improvement were also highlighted. These included stress management, communications and learning. Although all the results are being analysed at unit- or department-level in order to tailor our actions to local needs, we're also strengthening our Group-level plans to continue to improve in these areas and stand as the responsible and attractive employer we aim to be.

▶ As such, we take any crisis as a supplementary reason to strengthen our environmental stewardship.

[1] Together with our decarbonization roadmap

During 2022, amid the energy crisis in Europe, we have accelerated our programmes aimed at reducing our specific energy consumption and CO_2 emissions.
We also adapted our organisation to give even greater coherence and visibility to those actions that look to minimise our environmental impact. This includes measures focused on reducing greenhouse gas emissions, but we also work on decreasing our impact on local biodiversity. As part of that, with the goal of boosting synergies, we appointed our Chief Technology & Sustainability Officer, as head of the new Recycling segment. His teams were already combining the responsibility over environmental management, industrial risks and the Energy/GHG action plan, including scrap optimization, together with Purchasing and a ResponsibleSteel Centre of Excellence. Now, with his supervision of our Recycling business, a more intertwined organisation has emerged - one capable of accelerating both innovation and the rollout of our plans.

Considering that the results of this organisational change will only become clear in the medium term, and taking into account the low level of activity in the second half of the year, the fact that our 2022 report confirms our superior GHG footprint is all the more impressive. In 2022, we recorded a 0.32*CO_2e/ton of crude steel[2], far from the sector's 0.9 sector's average established by the International Stainless Steel Forum. This good performance, together with our optimised use of steel scrap made possible by the tighter links woven with the former ELG, give us confidence in our ability to reach our 2030 (-30%) and 2050 (net zero) goals and to stand as a strong contributor to the global carbon neutrality (scopes 1+2) we strive for.

In parallel, our past actions have gained us the recognition and encouragement of the Carbon Disclosure Project (CDP), improved to an A- grade rating on the Climate Change questionnaire, and earned a B for the Water Assessment at our first attempt. This means a lot to us, as we aim to further reduce our natural resources usage and become progressively less dependent on local rivers. On the air emissions side, we also report a drastic reduction in the dust emission intensity, to the benefit of the communities around our plants, particularly around our Timoteo units.

We will continue in this direction to live up to the trust of our people, who confirmed in our last Employee Climate Survey that they see us as an environmentally responsible company.

▶ Along the same line, Aperam continues with its active ethics, stakeholders' engagement and corporate citizenship initiatives.

Maintaining strong partnerships with our business counterparts and communities is an integral part of how we do business as usual - something we continued to do in 2022. For example, in Europe, we continued our actions to promote both our industry and the regions we operate in with Open Days being held at some of our major plants. In Brazil, our Foundation continues to stimulate the economic development of local communities by providing education programs and training.
Unfortunately, these activities have also been impacted by the war in Ukraine. In light of the humanitarian crisis the war has caused, we strived to support the refugees around us, particularly in Poland, along with addressing the many effects the conflict has on our partners and stakeholders. We've also tightened our Ethics & Compliance due diligence in view of strengthened economic sanctions, regulations, export controls and broader ESG matters.

Speaking of a comprehensive approach to ESG, following the 2021 certification of our Stainless Europe's four main operations under the ResponsibleSteel™ framework, in 2022 our Timoteo unit underwent its ResponsibleSteel™ audit, which concluded with the official certification being granted in February 2023. As a result, Aperam is the first stainless producer to be certified in both Europe and the Americas. The thorough on-site inspection, which included exchanges with over 60 local stakeholders, involved considerable preparation work by our teams. But it was all worth it as we are all proud to have shown our current responsible practices and to have accepted the challenge to do even more.
Taking pride in our achievements and work is fantastic fuel for motivation and innovation - which we use to develop both customer-oriented solutions and sustainably-driven innovations. A perfect example of this is our recently announced Botanickel partnership. This venture aims to leverage our agricultural skills and set a new standard in the sustainable production of biosourced Nickel, using hyperaccumulator plants while developing a framework fully attentive to the climate, biotope and local communities.

Looking ahead, with approximately 25% of our workforce creating value from the renewable and recycling upstream market, including our FSC©-certified Brazilian forestry, Aperam is better prepared than ever to face any challenge, keep its commitment to responsibility, and deliver a life-lasting material that will help build the sustainable societies of the future.

Sincerely yours,
Tim di Maulo
Chief Executive Officer

[2] Scopes 1+2, including the sequestration effect of our Brazilian forests.

Company Profile

Aperam is a public limited company listed on the Luxembourg stock exchange and on Euronext Amsterdam, Brussels and Paris.

> 6 main plants

> 4 melting shops: Timóteo (Brazil), Châtelet and Genk (Belgium), Imphy (France)

> 5 main cold rolling sites: Timóteo (Brazil), Genk (Belgium), Gueugnon, Isbergues and Imphy (France)

> 1 FSC®-certified BioEnergia eucalyptus plantation and charcoal production facility (Brazil)

> 1 Recycling network (Worldwide)

> 1 Distribution network (Worldwide)

EUR millions unless otherwise stated [1]	2022	2021	2020	2019	2018
Crude Steel *('000 metric tons)*	***1,931***	*2,169*	*1,959*	*1,985*	*2,287*
Shipments *('000 metric tons)*	***2,309***	*1,819*	*1,677*	*1,786*	*1,972*
Revenues	***8,221***	**5,144**	**3,656**	**4,287**	**4,704**
Operating costs [2]	***6,418***	3,393	2,799	3,378	3,635
Employee wages & benefits	***675***	534	481	517	527
Payments to providers of capital [3]	***342***	249	146	240	205
Payments to government	***130***	136	80	37	75
Community investments	***0.7***	0.6	0.4	0.3	0.3
EBITDA	***1,076***	**1186**	**343**	**357**	**504**
Economic value retained	***655***	831	150	210	332
Direct economic value generated	***8,221***	5,144	3,656	4,287	4,704
Economic value distributed	***7,566***	**4,313**	**3,506**	**4,077**	**4,372**

1 Differences between "Global Aperam" and the sum of the different regions and segments (next page) are due to all operations other than those in clear, together with inter-segment elimination and/or non-operational items that are not segmented. For Full-Time Equivalent Employees (see next page), it is related to Headquarters and 'transversal functions' (HR, IT, etc.).

2 Operating costs include R&D costs of EUR 21 million for Aperam Group for 2022.

3 Payments to capital providers = Net Cash Interest and dividends paid to capital providers and shares repurchased through share buyback programmes during the year, in line with an amount of interest paid (net) of EUR (3) million, EUR 4 million, EUR 7 million, EUR 5 million and EUR 5 million, dividends paid of EUR 151 million, EUR 140 million, EUR 139 million, EUR 142 million and EUR 130 million, and shares repurchased for EUR 194 million, EUR 105 million, nil, EUR 93 million and EUR 70 million stated in the cash flow statements of the 2022, 2021, 2020, 2019, and 2018 Annual Reports respectively.

About Aperam

Our Offering

RECYCLING & RENEWABLES

Scrap is our key raw material, Charcoal our major energy

> ELG is a global leader in the trading, processing and recycling of scrap for the stainless steel industry & market leader in the recycling of high performance materials such as superalloys and titanium mainly for aerospace
> BioEnergia produces wood and charcoal from FSC certified eucalyptus forests (128,000 ha)
> Recyco recycles metal from dust, mud, residues, ashes, etc.

STAINLESS & ELECTRICAL

Amongst the largest producers of stainless steel globally

Europe:
> 2 Electric Arc Furnaces (EAF) use scrap as major input material
> Stainless steel flat product output

South America:
> 2 Blast Furnaces (BF) use iron ore and charcoal produced from own forests
> 2 EAF use recycled scrap
> Stainless flat products & electrical steel

SERVICES & SOLUTIONS

Aperam's distribution arm

> Services & Solutions (S&S) provides value added and customized solutions through further processing according to specific customer requirements. S&S core activities:
> Direct sales of Aperam products to end users
> Distribution of Aperam and third party material
> Transformation services, according to specific customer requirements

ALLOYS & SPECIALTIES

Top 3 producer of nickel alloys globally

> Aperam specializes in nickel alloys and specific stainless steels
> Our products take the form of bars, semis, cold-rolled strips, wire and wire rods, and plates, and are offered in a wide range of grades
> High value items that are often sold on a kg basis

Aperam Performance by Division GRI-201-1

			Stainless & Electrical Steel		Services & Solutions	Alloys & Specialties	Recycling & Renewables
Aspect	**Indicator [1]**	Unit	**Europe:** Genk, Châtelet, Gueugnon, Isbergues, Precision	**South America:** Timóteo	**Worldwide:** 14 service centers 5 transformation units 15 sales offices	**Worldwide:** Imphy, Amilly, Rescal Imhua (PRC), Indore - ICS (IN)	**Worldwide:** Aperam Recycling, Recyco, Bioenergia
People	**Own Staff (End of Period)**	**FTE**	2,771	2,262	1,510	1,204	2,055
Shipments	Shipments	kt	1,018	582	642	27	1,358
Economic Contribution	Revenues	m€	4,134	1,492	2,760	663	2,438
	Wages & Benefits		311	79	87	73	108
	Payments to Capital Providers [3]		156	188	26	0	1
	Community Investments		0.08	0.42	0.03	0.01	0.1
	Payments to Government		28	58	18	5	8
	EBITDA		393	398	93	53	86
	Economic Value Distributed		3,778	1,326	2,701	612	2,354

Aperam's CEO, Head of Strategy, CFO and Board of Directors' Members (BM), from left: Sandeep Jalan (BM), Ros Rivaz (BM), Lakshmi N. Mittal (Chairman), Vanisha Mittal Bhatia (Aperam Chief Strategy Officer), Tim di Maulo (Aperam CEO), Bernadette Baudier (BM), Aditya Mittal (BM), Roberte Kesteman (BM), Sud Sivaji (Aperam CFO), Alain Kinsch (BM)

All footnotes are the same available on the previous page.

About Aperam

Our Main Sites

Châtelet (Belgium)
Melt shop and hot-rolling mill

Genk (Belgium)
Melt shop, Cold-rolling and finishing

Timóteo (Brazil)
Melt shop, Cold-rolling and finishing

Isbergues (France)
Cold-rolling mill and finishing + Recyco

Gueugnon (France)
Cold-rolling mill and finishing facilities

Imphy (France)
Melt shop, Cold-rolling and finishing

Our Values

Leadership

By being a bold, creative and courageous market player, we will lead the way in promoting sustainable solutions.

Agility

While changing market conditions require us to move quickly and adapt, we must remain flexible enough to meet our customer's specific requirements.

Ingenuity

Our people are skilled, imaginative and innovative and have a passion for sharing their skills. This ingenuity leads to new ideas and new solutions.

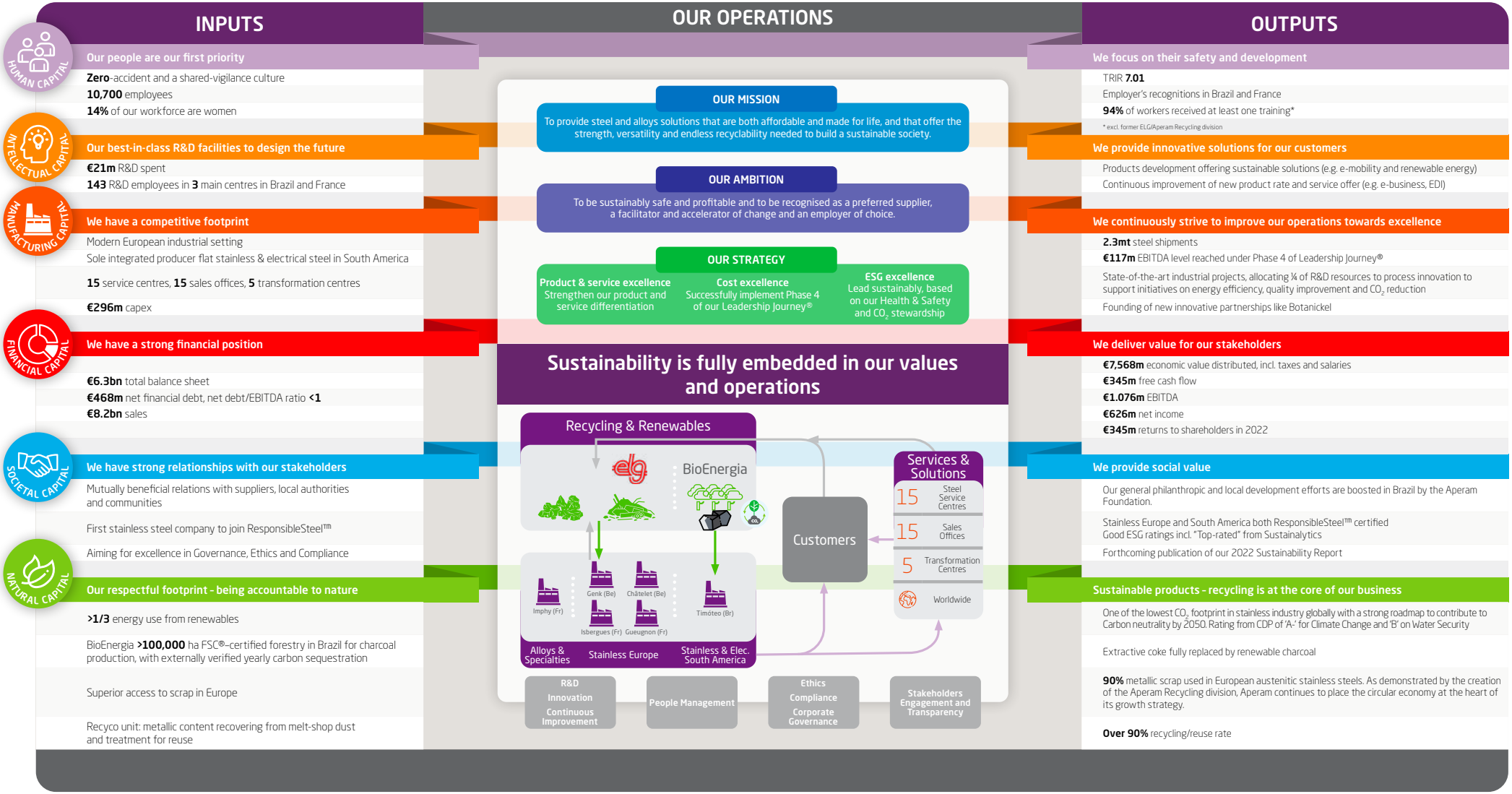
Site Certification

Division	Site by sub-segment	ISO 45001	ISO 14001	ISO 9001	IATF 50001	IATF 16949	Others
Stainless & Electrical Steel Europe	Châtelet	x	x	x			ResponsibleSteel TM
	Genk	x	x	x		x	ResponsibleSteel TM
	Gueugnon	x	x	x	x	x	ResponsibleSteel TM
	Isbergues	x	x	x	x	x	ResponsibleSteel TM
	Pont de Roide	x	x	x	x	x	
South America	Timoteo	x	x	x		x	ResponsibleSteel TM
Alloys & Specialties	Imphy	x	x	x		x	
	Amilly	x	x	x		x	
	Rescal	x	x	x			
	Imhua (PRC)	x		x		x	
	Indore (India)	x	x	x			
Services & Solutions	20 units, of which 5 Tubes plants.	14/20	11/20	20/20	4/20	5/20	1 SSC (Poland): SA8000
Recycling & Renewables	6 main yards out of 50 in Aperam Recycling.	3/6	3/6	4/6			1 ELG: Entsorgungsfachbetrieb
	Recyco	x	x				ResponsibleSteel TM
	BioEnergia	x	x				FSC® CoC & M

Other specific certificates and approvals can be found at https://www.aperam.com/documentation .

About Aperam

Our Business Model



Sustainability Strategy

In 2022, Aperam celebrated its first year after the purchase of the former ELG Scrap business network and continued its path towards Sustainability.
This path will be long as it is a continuous quest for efficiency together with responsibility, rooted in our values and practices and strengthened by a constant vigilance about the impacts we have and our active stakeholder engagement. It will also be made more difficult with uncertain economic context, energy hikes and raw material volatility.
This is why we consider it crucial to keep the long-term view, continue with our three-pillar sustainability roadmap in line with the Global Compact and Sustainable Development Goals and keep on challenging ourselves with solid external certification according to the ResponsibleSteel™ framework, reached for Aperam South America further to the 2022 audits.

> People and their health & safety will always come first.
Beyond the constant attention we give to Health & Safety, we also commit to shaping a work environment that encourages our employees to thrive and develop the innovative ideas that will propel our company to the forefront of our sector. We do this by engaging with our employees, for instance through our All-Employee Work Climate Surveys, and working together to find the right personalised training, operating mode and development opportunities.
This is not only to keep them motivated and performing, but also to nurture a sense of being a part of the Aperam family, which is all the more so important to truly welcome our former ELG colleagues and re-invent our future together.

> As to the environment, we know that our sector's responsibility is greater than most. Therefore Aperam intends on paving the way towards the most sustainable practices that transform steelmaking with solid roadmaps to further reduce our CO_2 and air emissions, as well as our energy and water intake by 2030, and contribute to carbon neutrality by 2050. With these initiatives, recognized by an A and B rating from the CDP respectively on Climate Change and Water, we aim to minimise our environmental impacts today while also adapting to the many challenges posed by climate change.
But while we continue with our environmental roadmap, we have also started to leverage the expertise of our new Aperam Recycling & Renewables division for further optimization in terms of scrap usage and development of other renewable sources of materials.

> Whether in our relations with our stakeholders or our corporate decision-making process, **our governance is guided by our high ethical standards**. All our stakeholders have legitimate needs.
As a signatory to the United Nations' Global Compact and supporter of the United Nations' Sustainable Development Goals (particularly those highlighted to the left), we aim to address these needs by being a fair, transparent and trustful partner to our customers, lenders and suppliers, we also pledge to act responsibly with authorities and local communities, proactively address concerns, and contribute to the general good

Sustainability Governance in 2022

➤ **Members of the Board of Directors**: in charge of the overall management of the Company, they decide on the direction taken based on proposals from the Leadership Team (LT, Aperam's Management Committee), a group of eight senior executives headed by our CEO, Mr. Timoteo Di Maulo. The Board of Directors has two committees, the Audit and Risk Management Committee and the Remuneration, Nomination and Corporate Governance Committee.
At the Board level, sustainability topics are covered on a quarterly basis within the Audit & Risk Management Committee, which is responsible for ensuring that all risks are appropriately addressed, and at Board level too.

➤ **CEO**: responsible for Aperam's sustainability performance and compliance.

➤ **LT reviews**: on top of H&S weekly and monthly meetings, we used to have quarterly slots on the environment completed with ESG meetings. The latter were involving at least the CEO and the CTO, and other Functions, depending on the topics covered and they happened regularly (monthly in 2021-2022). Starting 2023, a dedicated ESG slot will be added at the beginning of the monthly LT meetings in order to have all functions and divisions' systematically on board.

➤ **Chief Technical Officer**, Head of Sustainability, Health & Safety, Environment, Industrial Risk & Innovation and Purchasing: responsible for steering the Sustainability Strategy, based on discussions with the rest of the LT and other stakeholders.

Collaborating at sector-level through ResponsibleSteel™

In 2019, Aperam was the very first stainless steel company to join the newly established ResponsibleSteel™ association. This initiative represents a milestone for sustainability in our industry, defining the best practices into a framework to be used for external audits with the aim to give (end) customers confidence in a steel company's commitment to responsibility. We are confident that the ResponsibleSteel™ standards will soon be similarly recognized as it deserves to be and, in anticipation of this, we use its framework to better structure our approach to Sustainability.

In 2019, Aperam actively participated in the creation of the first site-specific standard, in cooperation with the association's other members, including steelmakers, NGOs specialised in environmental or social topics, suppliers from the extractive industry, and customers. In 2020, Aperam continued to participate in the building of the product-level standard while also preparing to start the certification process for its first sites in Europe. In 2021, we had four sites in Belgium and France certified as per this framework and we continued to discuss a product-level standard with more detailed requirements regarding responsible sourcing and GHG emissions. In 2022, we underwent the ResponsibleSteel™ audit at our Brazilian site of Timoteo, leading to the granting of the certification in February 2023 after the holiday season.

Embedding a Sustainability State-of-Mind into All Processes

Incorporating our sustainability roadmap into everyday decisions and ensuring perfect alignment across the organisation requires more than just awareness-raising actions. It also takes prioritisation and incentivization.

Since 2018, company-wide objectives have been cascaded into the individual objectives of all exempts across the organisation, starting by our CEO, whose first objective chapter is entitled "Health, Safety and Sustainability" and encompasses such topics as "Health" and "Sustainable Industry with a long term objective of zero impact on the environment". Other CEO objectives cover the topics of "Compliance and Company reputation" and includes business ethics, and "Diversity", which starts with a clear focus on gender.
Since 2019, these objectives have been incorporated into MyHR and, since 2020, for the 2021 exercise, we have introduced the categorisation of all our internal objectives according to our GRI analysis and subsequent 'material aspects' (see below and appendices).

In 2021, a new step was taken with the preparation of a revolving credit facility including two ESG-driven indicators. This Sustainability-Linked loan, finalised in February 2022, aims at leveraging Aperam's sustainability profile, as a borrower, by aligning the loan terms to our sustainability performance against predetermined indicators picked up to reflect our commitment and key focus, namely our H&S performance (using the TRIR indicator, see also page 15) and CO_2 improvements, both of which reviewed under limited assurance by an external party.
This means that reaching our objectives will trigger a reduction in our financing costs (1.5bp by indicator), but failing to do so will generate an increase in the same proportion. Any such "bonus" fostered by this framework will be entirely allocated to the financing of more projects in the area, meaning in relation with our people, Well-being and Human Rights, on the one hand, and on Climate Change mitigation, recycling and Environmental care, on the other.
This is a new token of our commitment to Sustainability.

Strategic directions

> In 2021, Aperam decided to reflect its strategic orientation towards a responsible usage of resources and full circularity by the conclusion of the acquisition of ELG, a global leader in stainless steel and superalloys recycling.
ELG is a global leader in collecting, trading, processing and recycling of stainless steel scrap and high performance alloys, and constitutes an integral part of the stainless steel and superalloys value chain, forming the link between industrial customers, local scrap handlers and mills & melt shops that purchase globally. With ~1,100 FTEs in 51 locations globally, Aperam Recycling continuously contributes to reducing the stream of metal waste: 1.4 million tonnes of recycled raw material were shipped in 2022 to be transformed into new products.
Investing in sustainable recycling will further improve Aperam's leading environmental footprint and support the company's CO_2 reduction targets. The acquisition shall enable

Aperam to improve its input mix and to expand into the supply of recycled raw materials.
The upstream value chain extension through the combination with ELG is a transformational addition to Aperam's business model. This will also be expressed in Aperam's operating segments. As from the 2022 financial statements onward, ELG has been reported, together with Recyco and ASB Recycling, as part of a new operating segment named "Recycling". This expresses the importance that the circular economy has to Aperam.

> In addition, after preliminary preparation works conducted in 2020, we launched in 2021 the certification of our first units under the ResponsibleSteel^{tm} framework. As a result, and after two auditing steps including an extensive one-site audit and over tens of exchanges with local stakeholders, in September 2021, we had five units, including four of our main European plants, granted the site-level certification as a "cluster" of site, thereby standing as the pioneers of our Stainless sector. Further the 2022 certification field works, with main audit phases in July and October, we received the official confirmation of Aperam South America ResponsibleSteel^{TM} certification that was publicly released in February 2023.
We thank all our teams for their commitment which made this pioneering achievement possible.!
This achievement evidences our strategy to position ourselves as the leader in the responsible production of stainless and alloy solutions. Indeed, considering the exacting standards set up by this framework, we firmly believe that it is the perfect structure to ensure continuous improvement in terms of sustainable practices and to provide to our customers the externally verified assurance that we walk our talk.
Going further, we expect to continue rolling out the best practices recommended by this certification across all our sites.

Working and Reporting on the Right Topics

Since 2013, we have used GRI standard principles (Global Reporting Initiative's sustainability reporting guidelines) to define our most material sustainability issues and their impact, based on both our business and our stakeholders' views, and have structured our reporting accordingly.
The matrix ranking all topics from minor to most critical is updated annually, and progressively enhanced for a greater relevance. See the main steps below:

> 2013 and 2014: materiality matrix based on our six major sites.

> 2015: update based on a survey of Aperam's employees.

> 2016: update on a broader scope to cover 11 major sites and 85% of our staff.

> 2017: systematic assessment of all the topics in the existing matrices with local authorities at each of our main sites. This resulted in the addition of a few new topics: "Urban Integration", "Industrial Risk" and "Noise".

> 2018: update on an identical scope and method and integration of key takeaways from our all-Employee Global Climate Survey.

> 2019: update based on the discussions held in the ResponsibleSteel™ forum, leading to the integration of information on decommissioning and biodiversity, even though these topics are not particularly relevant to our sites.

> 2020: update on an identical scope and method and integration of the analysis of our CTO and Head of Sustainability.

> 2021: update of the matrix was made based on the same 11 major sites, and methodology, complemented by the feedback of our CTO in charge of Sustainability. It was also cross-checked in view of the most recent Employee Global Survey, conducted in October 2021 and recording a 70% response rate on our workforce.

> **2022:** update of the matrix was made based on the usual 11 major sites. It was also cross-checked in view of our latest Employee Global Survey, conducted in October 2022 and recording a 77% response rate on our workforce.
More of a novelty, we also listened to the perspectives of our newly acquired ex-ELG units with the aim to ensure that our Sustainability issues are well in line with what is the new Aperam. As a result, we had three different former ELG perimeters to undergo the materiality assessment under the GRI logic and using the Aperam methodology.
The result of this exercise was the identification of the radioactivity alerts as a singular topic to the new Aperam Recycling units. Although the topic was not fully new to us, our steel plants being fully equipped with detection portals, we decided *not* to consider the topic as part of the existing "Pollution Prevention" issue and isolate it in a more product-oriented way, in line with the experience of our recycling units.

Beyond this sole add-in, no major change in our materiality exercise is to be reported in 2022. For full details on our final 'GRI Materiality' consolidated matrix and its variations, please see our online methodology appendices.

Our People

Our top priority is the health and safety of our people. As a core value, health and safety guides all our actions.
While we work on programmes to improve the safety, health and well-being of our employees, we also invest in employee development programmes.

Our business strategy heavily relies on the acquisition, development and retention of key technical competencies.

Health & Safety

Organisation

The year 2022 was marked by a return to normality after the Covid pandemic. Gradually, we went from a central coordination of actions towards a local governance, adapted to the environmental situation of our activities, with the possibility to restart our central coordination when needed.
We have therefore decided to end the central coordination of the COVID Guidance, leaving the local units to link up with local governmental rules, with possibility to restart our central coordination when needed.

2022 was also the year in which we integrated our colleagues of Aperam Recycling (former ELG) into our H&S Roadmap. We aligned practices, metrics and rituals with each other. The result becomes visible in the 2023 H&S Roadmap which is fully aligned with the Aperam approach, including very ambitious targets both on leading and lagging indicators for the new division.
We have also continued with the 2021 add-ins to our program, including the Just Culture roll-out and the new dedicated Health program, covering multiple initiatives from physical health over mental health and promotion of healthy lifestyle, all because we are convinced that motivated and healthy employees make the difference.
However, given our industrial environment, Safety will always be a key component of our approach towards H&S. In 2022 we decided to change our organisational structure from a model of facilitation and sharing towards a model of transversal steering and implementation.

This has resulted in the creation of H&S Divisional Lead functions, which are closely working together with their designated Division to implement the Global H&S Roadmap.

As a result, a company wide H&S 2022 Action plan has been established, detailing annual focus points for all sites. The plan consists of both lagging indicators - TRIR - and leading indicators which are composed of improvement actions all sites have to take on both Health and Safety related topics. Validation of the target achievement is being done via the H&S Divisional Leads in Q1 of the following year.

Voice

"In order to meet our ambitious 2026 goals and to be the company in which Health and Safety is a true Core Value, we need all of us to participate at all levels in the organisation.

Together we can and will make the difference."

Hans Vanhorebeek
Head of Aperam Health & Safety

Voices

"The year 2022 was a pivotal moment for Aperam, with the combined challenge to address the booming economy of the first half and a much lower second semester while integrating the former ELG employees within the Aperam family.

We had to find and/or develop the right talent to grow our business and develop innovative solutions in spite of the hikes. We also had to nurture a true sense of belonging for our Company that likes to see itself as a key link in the circular economy, with over 25% of its workforce delivering value from renewable or secondary material, when counting the new Aperam Recycling & Renewables Division together with our European meltshop teams.

Having this mission in mind is a strong lever for motivation for all our employees."

Head of IT and Communications

At a glance (GRI 403-1,5,9, GRI 404-1,3)

Indicator	Unit	2022	2021	2020	2019	2018
Employee	FTE	**10 736**	**9 522**	**9 381**	**9 612**	**9 777**
Joiners		819	623	393	514	665
Leavers		703	431	583	664	483
Turnover Rate	%	7.4	4.6	6.1	6.9	4.8
Women	% staff	**14.7**	**13.5**	**12.6**	**12.3**	**11.8**
	% exempts	22.8	22.4	21.4	20.4	20
Fatalities - All	#	**1**	0	0	0	1
Fatalities - Employees (1)		0	0	0	0	1
Fatalities - Contractors		1	0	0	0	0
TRIR - All	/1,000,000 hours	**7.01***	**6.98**	**5.69**	**6.39**	**n/a**
TRIR - Employees (1)		7.8*	7.59	6.60	6.54	n/a
TRIR - Contractors		5.24*	5.61	3.80	6.03	n/a
LTIFR - All		**2.45***	**2.22***	**1.52***	**1.7***	**1.4***
LTIFR - Employees (1)		2.89*	3*	1.58*	1.6*	1.4*
LTIFR - Contractors		1.48*	1.6*	1.39*	1.9*	1.6*
Severity Rate - All	/1,000 hours	**0.17***	**0.12**	**0.14**	**0.09***	**0.08***
Training Hours - Total (2)	hours/FTE	**27.3**	**30.8**	**19.6**	**35.5**	**34**
Total People Trained (2)	#	8 924	8 699	7 898	8 950	9 391
Absenteeism (2)	%	**3.2**	**2.7**	**3.4**	**2.7**	**2.3**
Employee satisfaction (3)	%	**75**	**83**	**n/a**	**n/a**	**86**

** Data with an asterisk received external assurance.*

3 GOOD HEALTH AND WELL-BEING

5 GENDER EQUALITY

(1) Including interim workers.
(2) Excluding ex-ELG units from Aperam Recycling.
(3) Employees that would recommend Aperam as a good employer - All employees.
Note: New Aperam Recycling & Renewables units (ex-ELG) incorporated as from 2022, except otherwise mentioned as (2), and in which case impacting the historical comparability

2022 Fatality

April 5th 2022 was marred by the fatal accident involving a subcontractor employee at our plant in Viracopos, Brazil. The accident occurred while the employee was working on a roof. We deeply regret this loss and our thoughts go to his relatives.

Even though we have procedures to mitigate the risks related to working at heights, this incident reminds us that our work to become a sustainable, safe company is far from finished. We remain committed to further controlling the risks present at our sites.

Safety Performance (GRI 403-2/3/9, 404-1) - Excluding the former ELG units of Aperam Recycling.

By Geography	Unit	Belgium	Brazil	France	Worldwide
Plants, Division	sites	Châtelet, Genk, ASB recycling from Stainless Europe	Timóteo, BioEnergia from Stainless & Electrical Steel South America	Imphy, Amilly, Rescal from Alloys; Gueugnon, Isbergues, Pont-de-Roide from Stainless Europe	Imhua (PRC), ICS (IN) from Alloys & Specialties Usti (CZ), Rodange (LU) from S&S Tubes
Service Centres		Genk (BeNeLux).	Campinas, Ribeirão Pires, Viracopos, Caxias do Sul	Isbergues	Germany, Italy, Poland, Iberica, USA, Argentina, Turkey, Uruguay
Main Offices		(Genk)	Belo Horizonte and São Paulo	Saint-Denis	Luxembourg HQ and Sales Offices(1)
LTFR - All	per 1 million hours worked	**4.46**	**0.15**	**4.74**	**0.75**
LTFR - Employees (2)		4.04	0.13	4.92	0.79
LTFR - Contractors		5.30	0.16	3.95	0.00
Severity rate - All	per 1 thousand hours worked	**0.49**	**0.02**	**0.31**	**0.04**
Severity - Employees (2)		0.45	0.00	0.33	0.04
Severity - Contractors		0.57	0.04	0.22	0.00
TRIR - All	per 1 million hours worked	**13.39**	**1.97**	**11.18**	**2.62**
TRIR - Employees (2)		13.80	1.59	11.26	2.36
TRIR - Contractors		12.59	2.45	10.85	7.58

(1) Canada, China, Czech Republic, Dubai, India, Japan, Korea, Mexico, Nordic, Russia, Switzerland, Thailand and the United Kingdom.
(2) Including Interim workers.

Understanding Our 2022 Performance

Looking back at our 2022 performance, we see a world of opposites.

On the one hand, April 5th 2022 was marred by a fatal accident involving a subcontractor employee at our plant in Viracopos, Brazil. A full and in-depth investigation took place and corrective actions have since been defined and established across all Aperam sites worldwide, including Aperam Recycling, ensuring that such a tragic event does not happen again.

On the other hand, looking at our lagging indicators from our historical perimeter, we clearly see an improvement over the year. Our 'Lost Time Injury Frequency Rate', which (LTIFR) measures time lost due to injuries, dropped from 2.2 in 2021 to 1.8 in 2022. Our TRIR (Total Recordable Injury Rate), which looks at the number of total recordable incidents and compares it to the number of total hours worked by all employees in a single year, went from 6.9 in 2021 to 5.9 in 2022, below our target of 6 for the year. In this case, a recordable incident is any work-related injury or illness that results in either death, loss of consciousness, days away from work, restricted work activity, transfer to another job, or medical treatment beyond first aid.

This improvement was achieved during the second half of the year, with clear lower incident rates at our sites. In fact, our Timoteo plant in Brazil set a record performance, going for more than a year without a lost time incident.

Within this same historical scope, our accident severity rate increased, from 0.12 in 2021 to 0.15 in 2022. This is mainly due to the lost days relating to the fatal accident and an increase in days lost in our Stainless Europe Division compared to similar accidents during prior years.

With the acquisition of the former ELG units, now called 'Aperam Recycling', our overall LTIF indicator ends 2022 at 2.4, while our TRIR comes to 7.1.

These results show that our decision to install strict H&S rituals, backed by a strict implementation of our standards and a focus on our culture and wellbeing, as our leading indicator set, is the right one to follow. Our 2023 TRIR target remains unchanged, at 5.5 for the new complete perimeter.

"Our commitment to the Health and Safety of all employees and stakeholders is a clear component of our brand promise "made for life". Our target is to become one of the best-in-class steel manufacturers in Health and Safety and ultimately a sustainable safe company."

Timoteo di Maulo
CEO of Aperam

Health and Safety Roadmap 2023

Based on our commitment to become one of the best-in-class steel manufacturers in Health and Safety and ultimately a sustainable safe company, we continue on our ambitious Health and Safety Roadmap. We keep focusing on People and their Personal Contribution, on Wellbeing as well as on Occupational Safety, on Standards and rules and Learning and Culture. All this aiming Aperam best-in-class, resulting in a TRIR lower than 3 by 2026 and so avoiding harm to our employees and stakeholders.

As a result, we came up with an updated paradigm on Health & Safety that should become and remain at the core of all that we will do on Health & Safety in the future. The paradigm is leading to 4 major pillars, which are:

Target

aim for best-in-class performance

2026 TRIR <3

1. **Just Culture:** A Just Culture inside our company, meeting the need for rigor in applying standards and the ability to fail safely
2. **No Repeat:** A "No repeat" policy, to build a learning organisation
3. **Workers' involvement:** The involvement of everyone. People are the solution
4. **Workers Wellbeing:** The physical and mental wellbeing of our people.

The key elements of our 2023 Safety Action plan, linked to the above paradigm, are:

- Focus on the implementation of our Life Saving Standards on Isolation, Functional Safety, Working at Height and Contractor Management to ensure a fail safe environment,
- Strengthening our Safety Culture via the roll-out of an Aperam wide Incident reporting, investigation and action tracking tool called Just Report,
- Ensure worker involvement in our approach via deployment of our Safe All Together training and the creation of mixed working groups consisting of employees, social partners and managerial line to work on risk reduction.

Wellbeing of our employees is the fourth key pillar of our new paradigm. A dedicated Health Roadmap 2022 - 2026 has been created which resulted in a detailed action plan 2023, containing the following key elements:

> A dedicated focus on Mental Health via the launch of a European Psychosocial Risk Assessment with our Worker Wellbeing as central concept and which reflects the perception of the employees (see also page 28).

> Awareness creation and training on Wellbeing for all our Management Layers

> Continuation of our effort to improve the status of our sanitary facilities and restrooms

> Continuation of our Ergonomic improvement plan both in operations and offices

Several initiatives are undergoing as part of this program, as is illustrated further.

■■■ In 2022, Aperam South America was very active on health-related projects. One of those projects focused on ergonomics and was based on an employee survey and a preliminary ergonomic evaluation of the entire Timóteo plant, together with our local offices (incl. Belo Horizonte and São Paulo). On top of verifying compliance with local regulations, the objective was to assess the needs and implement necessary measures to prevent improper ergonomics. In the end, 300 actions were recorded, which will help reduce or even eliminate possible occupational diseases and risks of accidents related to ergonomic issues. On a different note, the unit developed a specific program for employees in managerial roles, namely the Supervisors, Area Managers and Executive Managers.

The 'Taking Care of Those Who Take Care' program envisioned four goals: to support the physical and emotional health of managers; strengthen their bond with the Health Department; raise awareness about the importance of psychological safety; and support areas with more acute issues - all with the aim of stimulating our care actions and sentiment towards our teams for the benefit of everyone.

75% employees think that **Aperam culture** allows to learn from our errors

Stainless Steel Industry Safety Awards 2022

For awarding companies in the safety section, the jury looked for practical innovations that reduce the number of safety incidents in the workplace and/or develop transferable countermeasures to avoid specific injury types and develop both controls and workers skills / cultural mindsets to directly reduce the number of safety incidents.

Our Just Culture concept was recognised with a Gold Safety Award.

The Just Culture Standard has 2 main goals:

1. To value the positive more, to have a culture where the positive consequences outnumber the negative.
2. To ensure that people are treated fairly, without blaming and punishing them hastily - but remaining strict and clear about unacceptable behaviour - by providing a consistent impartial and objective approach when analysing events.

■■■ In our last Climate Survey (conducted at the end of 2022), a significant number of employees noted experiencing a high level of stress. Amongst one the responses defined (see also p. 28), the company came up with a new individualised solution called myCo@ch. Launched in April 2022, myCo@ch is an individual support program for employee wellbeing and health. Currently in a pilot phase, the app is available to all our employees in Belgium, France and Luxembourg.

The innovative app uses a blend of e- and personal coaching, presented via learning modules and video call sessions. It is designed to provide the user with the knowledge, techniques and tools they need to boost their physical and mental wellbeing and to promote professional and personal development.
The app is 100% online and available 24/7. It is also completely personalised, with the program based on the results of an initial assessment. All data and information is kept confidential. 380 active participants are already making use of the app, just 9 months since its launch!

Aperam Genk Mental Wellbeing Working Group.

■■■ European units are also active on the subject as can be evidenced in Genk.
For 1 year now, the members of the "mental wellbeing" working group of the Genk plant have been working together on various aspects of mental wellbeing and motivation. A first formally visible result is a formal "commitment" (vision) and its adoption at the committee for prevention and protection (CPP) at work on September 26th.
After the meeting, the commitment was signed by both working group members and CPP members. Meanwhile, everyone is aware of the many opportunities waiting for each employee to further develop mental wellbeing at our site.
The working group is composed of 17 members (see above) and they represent all the different populations in our organisation from Management up to Blue collars.

Voice

"From day one, the level of support we've received from our corporate partners has been great, and progress towards mutual objectives and goals has been ongoing. Our colleagues have made a concerted effort to understand our unique needs and integrate us seamlessly into their business process and operations. We have been impressed by their responsiveness, professionalism, and willingness to share resources and expertise.
Thanks to their support, we have been able to successfully navigate a period of significant change and still continue to deliver high-quality materials to our customers."

David McLaughlin
Global Head of HS&E, Aperam Recycling

A Highly Competent and Engaged Workforce

Diversity of Talent

Our Workforce at a Glance

At the end of December 2022, Aperam's workforce was made up of 10,736 employees (FTE), of which 11% are exempt and 65% blue collar employees (stable percentage compared to 2021). Our workforce was predominantly made of permanent and full-time employees - 97% each (GRI 2-7).
Our staff is mostly composed of employees based in Brazil (35%), France (23%) and Belgium (19%), these three countries representing 77% of our workforce.

See the Tables (1) and (2) further for more information.

Aperam Workforce (1) (GRI 2-7)

2022	Gender	Permanent	Fixed-Term	TOTAL	Full-Time	Part-Time
Blue Collars	Female	541	9	**550**	542	8
	Male	6,213	171	**6,384**	6,242	142
White Collars	Female	729	19	**748**	656	91
	Male	1,824	22	**1,846**	1,799	46
Exempts	Female	273	3	**276**	253	22
	Male	927	6	**933**	915	18
TOTAL	**All**	**10,506**	**230**	**10,736**	**10,408**	**328**
2021	Gender	**Permanent**	**Fixed-Term**	**TOTAL**	**Full-Time**	**Part-Time**
Blue Collars	Female	464	11	**475**	468	7
	Male	5,751	158	**5,909**	5,856	53
White Collars	Female	550	16	**566**	494	73
	Male	1,530	15	**1,545**	1,514	30
Exempts	Female	223	4	**227**	205	22
	Male	794	6	**800**	787	13
TOTAL	**All**	**9,312**	**210**	**9,522**	**9,324**	**198**

Aperam Workforce Aperam consolidated total of Full-Time Equivalent employees, at 31/12/2022 (GRI 2-7)

Understanding Our 2022 Figures

> During the year 2022, 819 FTEs joined Aperam (excluding the integration of the newly acquired ELG business, now Aperam Recycling (part of Aperam Recycling & Renewables), of which 23.8% were women, while in parallel 703 FTE left, only 13.2% of them being women. This leads us to an employee turnover rate of 7.4% (excluding ex-ELG employees) slightly above the 6.4% in average for the 2016-2021 period.

The higher number of leavers is related to the closing of our Montevideo Tubes plant in 2022 following the productivity investment for modern Tubes lines in Brazil, next to resignations and retirements.

> In 2022, as these past few years, the average age of Aperam employees (women like men) was 42 and average seniority within Aperam was 11 years .The age distribution is not too different too, with 26.2% of our staff over 50 and less than 4.5% below 25.

Aperam Workforce (2) (GRI 2-7)

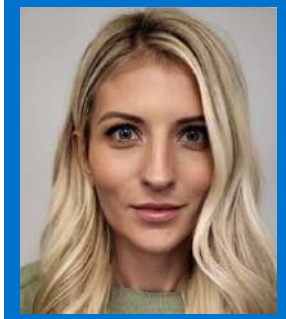
Indicator	Unit	2022	Average Age (y)	Average Seniority (y)	<25 yo	>50 yo	# Women
Total Employees	FTE	**10,736**	*42.3*	*11.8*	*5%*	*26%*	**1,573**
Blue Collars		**6,934**	*40.8*	*11.0*	*4%*	*14%*	**550**
Standard White Collars		**2,593**	*44.6*	*13.6*	*1%*	*8%*	**748**
Exempt White Collars		**1,209**	*46.2*	*12.5*	*0%*	*4%*	**276**
o/w "Top100" (Top10%)		**125**	*51.6*	n/a	*0%*	*57%*	**21**
Interim		**451**	*37.0*	*1.6*	*25%*	*15%*	*18*
Joiners		**819**	*40.0*	*0.1*	*12%*	*23%*	*195*
Leavers		**703**	*43.0*	*13.9*	*5%*	*35%*	*93*
Turnover Rate	%	7.4					
Average Workforce	FTE	**10,199**					
Headcount EoP	#	**10,848**					**1,618.0**

ELG's Integration into Aperam Recycling & Renewables

As of the end of December 2022, Aperam's workforce from the former ELG branch was 1,158 FTEs. These FTEs were located in 19 countries, including the United States (38%), Germany (20%) and the United Kingdom (11%). The smallest units employed just two FTEs, while the largest unit employed 445.
58% of these new colleagues are blue collar employees working in the scrapyards, while 34% are white collars and 8% exempt. Their average age is 45.

Furthermore, 18% of these employees are women, which is a higher overall rate than at Aperam. However, these female colleagues are predominantly white collar employees, with 16% being blue collars and 6% having a management role (exempts).

Admira, Senior Supply Chain Manager at Aperam Recycling (ELG Utica Alloys) in Herkimer, NY, USA.



Admira is a good example that equality among men and women can be easy and natural. As just a 21-year-old student from outside the industry, she set foot for the first time at ELG Utica Alloys in Herkimer, NY. Now, 14 years later, she is Production Control Manager.

Looking back, the former inventory clerk describes her former self as quiet and shy, but she rose above. *"I quickly learned that knowledge, experience and skill pay off, and it boosted my confidence"*, she explains. Her supervisor saw it the same way and rewarded her with a job on the Commercial Team and later as Production Control Manager.

ELG Utica Alloys is a business with some 10 locations worldwide, where superalloys scrap such as Nickel-base alloys, Cobalt alloys and Titanium are professionally recycled: precisely analysed, sorted and processed according to the requirements of the customers, mainly from the aerospace industry.
In this working environment, Admira never felt less valued or less respected because of her gender. Admira recounts, *"I was even offered better positions when I was a new mother. Especially in that regard, I feel that I was perceived as a valuable colleague rather than as a woman and a mother of 2 kids."* She says her boss, a family man himself, has always been understanding. But it is also her family's full support which enabled her to find a true work/life balance.
As Production Control Manager, Admira now oversees all aspects of ELG Utica Alloys New York inventory and logistics, working closely with Commercial and Operations to plan production and meet customer demand. She is also excited to be able to contribute and lead numerous initiatives at the Division level as well. *"As a beginner, it was hard for me to bring in new ideas , but I was convinced with facts and through my good preparation I finally earned my spurs."*

Admira started a new role as Senior Supply Chain Manager in September 2022.

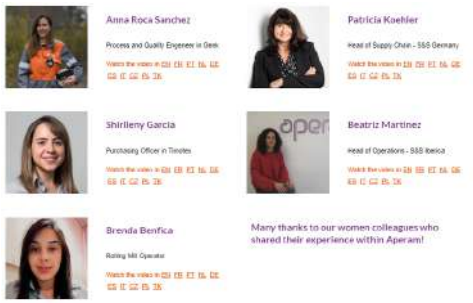
Tips to newcomers:
"As a young female coming into a male-dominated industry, I have learned that confidence comes with knowledge. So always be prepared and do your research. Show your ability to bring results to the table. Don't be afraid to ask questions and take initiative. In an industry that is constantly evolving it is essential to continue to evolve as an individual..."

Embracing Diversity - with a woman's touch

Since 2018, we have used a program inspired by the United Nations' Women Empowerment Principles to increase female representation across all levels of the Aperam community and to ensure our work environment allows our female colleagues to thrive and demonstrate the very best of their talents. The action plan is summarised by a specific Gender Equality & Diversity Charter with five main dimensions (our 2022 progress per chapter is laid out in the table on next page). The plan is regularly reviewed to integrate the input received from our all-employee climate surveys and other benchmarks.

> In 2018, our female employees had less favourable opinions regarding communication and career development. But our surveys from 2021 and 2022 show this is no longer the case, although significant gender-based differences do remain in some countries and plants (sometimes to the detriment of men). All figures must be fully analysed to fine tune local action plans.
> Because fighting stereotypes is a pillar of our action plan, we aim to have regular communications on the subject, both at the local and company levels. In March 2022, we had a global Aperam communication campaign celebrating International Women's Rights Day. Five Aperam employees from Belgium, Brazil, Spain and Germany recorded videos (sometimes with their colleagues, see below intranet picture and video extract) to speak about their experience working in a still too masculine industry.

Intranet page with all videos in many languages..



Extract of the video from Beatriz Martinez, S&S Iberica.

To illustrate the work being done to promote women at all levels and departments of Aperam, let's look at what's happening in France, Brazil and Italy:
■■■ In partnership with the French 'Elles bougent' association, Aperam created a group of 20 ambassadors from France and Belgium (see picture next page) from R&D, IT or production roles to reinforce gender diversity in the industrial and technological sectors. The ambassadors shared their passion through testimonies and mentored young women in their study and career choices. They also participated in events, where they answered questions and worked to inspire women to take the plunge into scientific and technical professions.

Status of Aperam's Gender Equality & Representation Roadmap

Leadership & Commitment
Improving Diversity & Inclusion is a key management target and it was reflected as such in our performance goals.

Health & Work Conditions
Aperam's working conditions should be safe and adapted for all employees. A specific gender focus is given in relation to restrooms, changing rooms, ergonomics and working clothes.

In 2022, several audits were done with members of the health circle (incl. staff representatives) across all sites to define gaps versus the Aperam Standard. An action plan had been put in place to solve all issues over max. 3 years. First concrete achievements in 2022. (example in Brazil, Inauguration of 15 restrooms for women and people with disabilities).

Equal Remuneration
Aperam is committed to providing equivalent remuneration based on the local market, for similar jobs and taking into account the performance, skills and relevant experience of the person doing the job.

In 2022, the gender pay gap decreased at 7.7pts (excluding Aperam Recycling) (versus, 7.9 in 2022 and 8.6 pts in 2021). We continue to watch closely all indicators to avoid any unfairness.

Equal Career Opportunities
Aperam is committed to providing equal career and development opportunities to all our employees. By monitoring the gender diversity of our talent development programs and succession plans, we ensure we continue to increase the number of women in management positions.

On top of keeping our Global Aperam Talent Management Program and monitoring our succession plans for leading positions, we also conduct a detailed analysis of the distribution of promotions and performance ratings: in 2022, 19.9% of women exceeded expectations vs 16.9% of men and 6.1% of women have been promoted vs. 2.9% of men.

Fight Against Stereotypes
A sustained focus on training and communication is required to get rid of any gender bias. Read our monthly "Career focus" within Aperam Newsletters.

In 2022, we continued our training to avoid gender bias, including any bias that might arise in the recruitment process. In particular, all white collar employees have been assigned a specific training module from MyHR, also specific training for HR and Managers recruiting without discrimination, prevention of sexism at work, Gamifying exercise on Diversity.

■■■ Aperam S&S Italy aims to increase the representation of women in the production areas of its Massalengo and Podenzano units. Over the last few years, they registered an uptake in the proportion of women on the shopfloor, from 2% in 2020 to 8% in early 2023!
The critical factor behind this success is the use of so-called 'hiring academies' - week-long training sessions for candidates with a high focus on health and safety. The academies also included 18 hours of passive training on the production lines: with candidates following one of our blue collars, who showed them the entire manufacturing process. The candidates were not supposed to do anything directly (being in a training phase), but only to learn more about the context and the kind of job they were applying for.
The local team is so proud of their first results that they decided to produce a specific video to celebrate the 2023 International Women's Rights Day!

Manuela, from Podenzano (IT) production area, claims:

'Women can easily work here'

Aperam 'Elles bougent' Ambassadors.

Voice

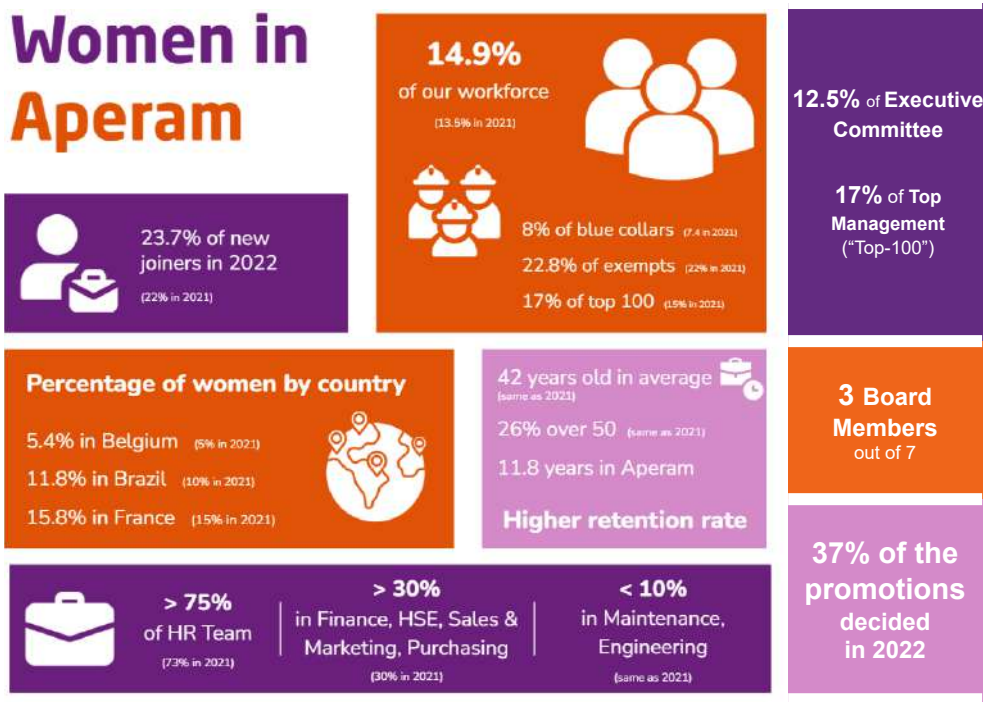
"The launch of this network of Aperam ambassadors should enable us to support the necessary change in our culture towards greater openness (diversity and inclusion), in addition to the missions carried out by the association.

It's really necessary to deconstruct all types of stereotypes, we all have the same capacities, jobs are not gendered! "

" 'Elles bougent' ambassadors' role is to be:
- informing, testifying, presenting our careers in the technological and industrial fields,
- encouraging vocations and participating in the information and career guidance of girls,
- contributing to deconstructing stereotypes linked to technical professions ,
- passing our passion and inspiring the strength to dare to choose a career path."

Margaux Roulet
Quality Engineer, Châtelet (Belgium)

Stéphanie Charre
R&D Technician, Isbergues (France)



■■■ Brazil went even further, designing a new extensive course specifically (228 hours of theoretical and practical training over four months!) to train local women as Steel Welding Operators. Part of our Inclusion & Diversity program, the program was a success, with around 100 registrations for 24 seats. In October 2022, the Aperam Acesita Foundation celebrated the first graduation ceremony for 12 Steel Welding Operator course female students.

Gisele Alexandre da Cunha Lima made Aperam history by being the first steel welder operator to be hired in Aperam South America. "*I found out about the welder steel operator course through my husband (also Aperam Employee). I realised then that I was qualified. When the opportunity arose to be interviewed by an area to compete for the vacancy, my heart throbbed with joy and beat faster when I received the news of the approval. It was a dream that was coming true. I just have to thank Aperam for giving women an equal opportunity to show that we are strong and can work in the industrial area.*"

Diversity in a Broader Sense

In last year's report, we highlighted our decision to expand our diversity program to include all kinds of diversity - not just gender. Consequently, a new position was created in Europe to tackle this subject (together with Mental Health and Employee Engagement). We also increased the number of questions about Diversity and Inclusion integrated within our Climate Survey and took the first steps to enlarge our action plan.

> We are happy to report that all the related survey questions were rated above 8/10, which is very good. We also can report an overall satisfaction rate of 7.5/10, with no significant deviation related to age, employee status or gender. Satisfaction is even higher in Brazil, where a full Inclusion & Diversity program was launched in 2020, with local 'Affinity Groups' providing the unit with ideas and energy.

> On the communication side, we celebrated Human Rights Day 2022 with a special focus on disability, highlighting both the many capabilities of people with disabilities and how we at Aperam can - and should - be better leveraging these capabilities.

A newsletter in 10 languages was dispatched to all Aperam employees, encouraging everyone to feel empowered to bring one's full self, pride and abilities to Aperam's success. The newsletter contained an e-Learning course and an awareness-raising quiz about people with disabilities. In parallel, specific guidelines were issued to avoid offensive vocabulary and to ensure company communications use inclusive language. See also the insert about the brilliant project by our Brazilian colleagues.

> As to the rest of the action plan, the new program also includes a multi-year calendar to raise awareness on all aspects of discrimination. We also rolled out a methodology to assess discrimination risks in the workplace and coordinated a global network of correspondents to share best practices and homogenise incident management. The plan also includes promoting different perspectives about leadership, resilience and success - all part of our ongoing fight against stereotypes.

Based on an initial risk assessment, performed in our three biggest countries of operations (Belgium, Brazil and France), we identified some priorities to be tackled in terms of awareness-raising. Our action plan now includes the global extension of our risk mapping and a focus on some specific moments in the career (hiring, promotion) and/or job status. 2023 will see the continuation of exchanges with our external partners to enrich this analysis and adjust our actions.

Also in store is the launch of a new routine, in the form of a 'Month of Diversity', to be held in March, starting with the Zero-Discrimination Day on March 1st...

Voice :

"In my life, I have seen many comments and behaviours that are biassed against people from minority groups.
Today, the Inclusion & Diversity Program is the company's great differential for me. I am very happy to work here and be leading the Aperam South America Race Affinity Group to advance Inclusion & Diversity inside as within our local communities."

Vanessa Marques
Aperam BioEnergia Environmental Coordinator

Timoteo's Professional qualification program for people with disabilities

The aim is to promote the inclusion of people with disabilities within Aperam with a qualification program. This tailor-made program consists of some 230 hours of theoretical learning and practical on the job training on the Timoteo site, and benefited 30 trainees in 2022.

"It was a challenging project with the objectives of fulfilling the quota for People with Disabilities in Aperam Timoteo and providing further social inclusion. A multidisciplinary team was created to successfully develop all the work.
This project opens our eyes to a new way of hiring and integrating people with disabilities and we hope it inspires other sites to follow the same path." says Cleonice Maria Alves, Continuous Improvement Analyst..
During 2022, 11 employees from this Program were confirmed with a permanent contract. Based on such a success, the project was easily recognized as the best amongst 9 projects as part of the Health, Safety and Environment category for the 2022 Continuous Improvement Challenge!

All data in FTE - GRI 405-1	2022			2021		
	Belgium	Brazil[3]	France	Belgium	Brazil	France
Total Employees	**2,030**	**4,061**	**2,482**	**1,913**	**3,579**	**2,426**
% Women	*5.3%*	*11.1%*	*15.9%*	*4.8%*	*8.4%*	*14.7%*
% Persons with a disability [1]	*1.3%*	*4.3%*	*4.7%*	*0.2%*	*4.0%*	*4.7%*
% LGBT+ people [2]	*n/a*	*n/a[4]*	*n/a*	*n/a*	*3.0%*	*n/a*
% Persons of colours [2]	*n/a*	*n/a[4]*	*n/a*	*n/a*	*63.3%*	*n/a*
Total Joiners	**175**	**338**	**265**	**66**	**208**	**48**
% Women	*9%*	*30%*	*22%*	*9%*	*15%*	*38%*
% Persons with a disability [1]	*n/a*	*0.6%*	*n/a*	*0%*	*9%*	*5%*

Herick, Commercial Controlling Manager São Paulo, Brazil.

Herick's Aperam story starts in 1999 when he took on a role as an apprentice. Following several years working on international projects outside Aperam, he returned to the company in 2017 as Demand Manager SAP South America – a role that saw him managing large teams and cross-unit projects.

Herick also spent some time in Europe, where he participated in the post-implementation of the warehouse management project in Genk (Belgium) – an initiative that he later helped replicate at our Timoteo plant.
In 2019, he became an evolution agent in the Evolve Program – Lean Office.

He currently serves as Commercial Controlling Executive Manager in São Paulo where, together with the Commercial Control team, he helps maximise profitability with current resources, in addition to reconciling the company's strategy with a commercial and financial vision to achieve short, medium and long-term goals.
"When I came back to Aperam I found a much more dynamic company," says Herick.
"I was happy for the opportunity to work in an environment that was conducive to collaboration and dedicated to diversity and inclusion – it was immediately rewarding."

Diversity is an important issue for Henrick. He serves as a member of the racial affinity group at Aperam South America and is a strong advocate for gender equality. *"Diversity is the key to a company's success,"* he says. *"Society is changing, and companies should strive to reflect that change, not only on the shopfloor, but also in the boardroom."*

Herick is currently working on a master's degree in global finance and, looking ahead, would like to continue developing and consolidating his knowledge in the field.

Tips to newcomers:
"Dedicate yourself to doing a good job. Always seek to develop professionally and be passionate about learning. The world is evolving faster and faster and we are challenged to keep up to date.
Don't be afraid to ask questions as that's how learning happens."

Footnote of left-hand table:
(1) According to local definitions/regulations.
(2) According to a 2021 survey from Aperam South America and BioEnergia where employees were invited to define themselves (or not), as part of the Brazilian Inclusion & Diversity program. 1988 responses were recorded, equivalent to a 60% response rate.
(3) Brazil Data (Industry + Bioenergia + S&S and Tubes).
(4) New survey to be done in 2023.
Persons of colour, as per the American labelling, being those defining themselves as "non-white".

Career & Development

Continuous digital transformation

Our HR Information System, MyHR, is supporting our objective to harmonise our HR practices and processes over Aperam. That's why we extend the functionalities to more and more employees, such as for our competencies reviews.
In 2023, the objective is to onboard people from Aperam Recycling, starting with the white collar exempts audience. Moreover in 2023, a new step will be reached with the deployment of an additional module in MyHR, focusing on internal job mobility and external recruitment (already planned for 2022 but delayed).

Competency Management

Our eight fundamental leadership competencies remain a pillar of our competency management. To go along with this foundation, we rely on specific business and technical skills that are critical to the future development of Aperam. Each year, the employees typically self-evaluate and are evaluated by their managers. All exempts participate in this process in MyHR, as well as a selection of non-exempts in Brazil and from 2022 all standard white collars and blue collars in our site of Châtelet which explains the jump of 76% from 977 to 1723 reviews. In addition to this, we also encourage through the MyHR platform the use of 180 degree feedback about competencies (stable in 2022 compared to 2021 which was the first year we introduced this new process). Assessing yearly an employee against these competencies allows us to define agreed development actions and help our people transform into their better self. In 2022, people have defined an average of 3.4 development goals per person (3.1 in 2021).

■■■ The "Bold Leadership" training for technical hierarchy (foremen, shift leaders and engineers) in Aperam Genk provides them with the necessary tools that they can use on the shopfloor in order to solve problems quickly and above all to make their teams function optimally. An example of such a tool is to learn how yearly evaluation or tasks/performance interviews can be managed in an efficient way, with the persons in our operational teams, based on the PPF techniques (Past Present Future).
Over 150 people were trained in 2022. The average score after evaluation of the satisfaction and the applicability with all our participants of the first sessions was historically high with 89.5%.

Job Mobility

Moving from one job to another is never an easy task: it requires agility and adaptability across the organisation. To support the internal mobility, the career details and aspirations are expressed by the employees during the mid-year review in MyHR. In addition, all open vacancies are published on the career portal which is a key tool to open up development opportunities. Later in 2023, the launching of the new recruitment module in MyHR should reinforce internal mobility and connect people to find new career opportunities.

Management by objectives

We believe in management by objectives and want to ensure that all employees receive clear goals. Performance Management via MyHR started with all Aperam exempts in 2018, before being extended to standard white collars progressively. Top Management of the company is highly involved in this process, as they define clear directions for the whole company with Organization goals set in MyHR that help the managers and their teams to define their own individual goals, fully aligned with the company goals. In 2023, we will also continue to integrate our Aperam Recycling division. Top 100 Aperam Recycling members should be fully embedded in the Aperam management by objectives process in MyHR before the year end.
We also have the possibility to ask for 180° feedback about our performance from other stakeholders in Aperam, especially for people working in platforms and project mode. To increase transparency and speed of the process, for the first year in 2022, the exempts were able to ask for feedback about their performance directly to any of their colleagues in MyHR without any validation of the request by their manager. Close to 30% of the exempts have used this possibility.

Performance Management in Aperam (excluding former ELG units) GRI 404-3

Indicator	unit	2022	2021	2020	2019	2018
Blue Collars	%	79	66	69	83	60
Standard White Collars		70	79	67	80	67
Exempts White Collars		97	99	99	97	98
Total Aperam		**79**	**73**	**72**	**84**	**68**
Exempts Reviews in MyHR	#	**1,117**	**1,051**	**1,005**	**1,002**	**927**
180° Feedback		520	566	427	498	432
180° Feedback on Competences		208	206	*n/a*	n/a	n/a
Non-Exempts Reviews in MyHR		**1,723**	**977**	**950**	**572**	**0**
Total Reviews in MyHR		2,840	2,028	1,955	**1,574**	927
Average Performance Goals		5.4	5.9	**5.8**	**5.6**	**7.3**
Average Development Goals		3.4	3.1	2.9	**2.7**	2.8

Employer's Integration

A systematic approach

To ensure that our new hirings are not only "onboarded" in optimal circumstances, but also go through a longer term induction and integration process, we build on what we have already put in place and launch new initiatives:

- During last year's report we mentioned the launch of an On-Boarding e-learning module covering H&S, Environment, Ethics & Compliance, IT, Performance and Competency Management and Leadership.
- A new approach involving the appointment of onboarding coaches has been started for managers joining Aperam. Usually the onboarding coach is a senior manager who can help the new joiner navigate in the organisation and identify his or her key stakeholders.
- With the support of an external consultant, an elaborate assessment was done with approx 15 managers who joined Aperam recently. The results of this survey were reviewed and discussed during a one day seminar by the Aperam Leadership Team. A debriefing session with the participants was organised in 2022. We hope the initiative will also lead to the creation of a Community of Aperam new joiners.

In 2022, after a stoppage due to the COVID crisis, we were able to resume the site visits in our main European sites for our local white collar exempt joiners. 53 newcomers had a great opportunity to discover our main plants and have a close contact with our core activities. Meeting colleagues from other sites and building a network outside of their area is always a plus when it comes to a successful onboarding.

A new Technical Talent Program

The program was launched in Genk, Belgium in 2022 and focused on attracting young graduate engineers and managing them as one community through their career at Aperam. Our Timoteo site in Brazil already had a similar program in place focused on young graduate engineers.
In the near future, we hope to extend this program to our French sites (starting with Imphy) and to our second industrial site in Belgium, Châtelet.

Welcoming Trainees and Apprentices

Aperam is always eager to attract youngsters' attention and communicate the vibrant passion of its teams. This is often done via the offering of training or apprenticeships, for instance:

- Aperam in Timoteo (Brazil) designed a specific exclusive development path for the 21 lucky 2-years trainees that joined in 2022, with visits to the country's units, tutoring, job rotations and individualised development.The 1st year focuses on Interface areas (Rotation in six months) and the 2nd year working in the end area – Innovation Project Development. See above the visual used for external communications

- Still in Brazil but in our Services & Solutions Division, Aperam Tubes Ribeirão Pires developed the Young Talents Program, which aims to retain, develop and train interns by offering the opportunity to complement their school education through professional experiences, projects and development, within Aperam's philosophy and culture. The interns have the opportunity to present their projects to the management, who gave feedback and suggestions for improvement.

- Aperam Recycling Germany has a yearly apprenticeship program focused on skills learning that help trainees prepare for their final exams. For example, we provide different training in self-organisation, basic science skills and waste incineration. The whole organisation program is presented during the welcome day, where they can also meet with old trainees for breakfast.

- Aperam Alloys Imphy has reintroduced visits to its workshop dedicated specifically to the work-study students to facilitate their integration and understanding of the issues. These visits took place through the EMA (École interne des Métiers et des Alliages) and helped create a bond of trust and talent retention.

Target

30 % Digital Learning rate by 2030

Right: 40 hours of training were offered to 36 operators from Aperam Tubos Viracopos (Brazil), so that they become autonomous on basic maintenance.

Learning & Training

Learning

Learning is an integral part of everyone's work and, to be "able to transform by learning" which is one of the 8 Aperam Leadership competencies, employees need qualitative and regular feedback from all stakeholders starting with the manager. That is why our Learning strategy is structured around continuous feedback in the first place, followed by training (traditional and increasingly digital) and internal mentoring and coaching.

Mentoring & Talent Management

The internal Aperam Mentorship Program has launched its 3rd wave in 2022.
Mentoring by experienced leaders remains one of our core tools to develop leadership skills. Besides the mentoring by LT members, we have developed since 2020 a program in which the mentors are mainly part of the Top 100 of Aperam and the mentees chosen among the most talented Aperam people. Our mentorship program is structured around Aperam's 8 leadership competencies. Communities of mentors and mentees have been created to exchange experience and best practices.
The program is well appreciated as shows our regular survey (at mid-mission 2022, 95% of the mentees estimated their mentoring mission was on the good way). After 32 pairs of mentor/mentee launched in 2022, around 30 new pairs will start in 2023. Our Leadership Team also actively participates in the program with mentees being mentored by them directly.
In addition to this initiative, 40 exempts identified as Talent had the opportunity in 2022 to participate in a special Top Leadership Program according to their roles.

Training

To pursue the objective of becoming a truly learning-oriented organisation, we are extending each year more the use of our own Learning Management System, which has been fully embedded within MyHR since February 2019. The platform is used to display, diffuse and manage our learning offer with a focus on digital content which we intend to create more and more internally within Functional Academies.

2022 Training Performance Indicators and Outlook

Training hours have increased at global level by 16% in 2022, back to a similar level before COVID-19. Looking at the digital learning hours, they increased by 17%, representing 18.7% of the total learning hours which is a stable ratio compared to 2021 (18,5%). However, we registered a significant increase of almost 230%, from 7 101 hours to 23 319 hours of the digital courses followed in our MyHR LMS, representing 34% of the total number of digital courses hours versus 13% in 2021.

- 43,513 e-learnings were completed, or an increase of 123% compared to 2021.
- Also, 6,092 unique learners have completed at least one course self-paced in MyHR compared to 3079 in 2021 (almost double), showing an important effort on completing the courses started.

> MyHR Learning is now open to all categories of employees. We expect that more and more sites will completely manage their training offer - including the face-to-face offer - in the tool, in order to get a single tool in terms of training management in all Aperam.
In 2022, Belgium is using MyHR Learning as their unique LMS and Services & Solutions has started the transition.
In addition, people coming originally from ELG, now Aperam Recycling, have started to get access as well in 2022:All exempts from Aperam Recycling (about 100 people) and about 60 white collar non-exempts from Utica USA. We have now a total of 10 090 employees accessing MyHR Learning (1237 exempts and 8853 non exempts).

Training Centre Maryse Bastié, Hayange - France, rey-de crécy atelier d'architecture © Valérie Trégan

2022 Training Follow-up GRI 404-1, 403-5. (excluding ex-ELG units unless otherwise mentioned)

Learning in Aperam	unit	2022	2021	2020	2019
Total Training Cost	k€	**6,430**	**3,929**	**3,190**	**4,627**
o/w Total Belgium		2,568	1,038	1,232	2,801
o/w Total Brazil		1,000	603	364	506
o/w Total France		2,596	2,155	1,493	1,135
Total RoW		199	133	100	185
Total Training Time	hours	***340,368***	***293,009***	***184,201***	***341,741***
o/w Total Belgium		*59,774*	*35,101*	*25,024*	*75,149*
o/w Total Brazil		*182,468*	*163,635*	*107,425*	*143,664*
o/w Total France		*61,424*	*69,365*	*38,055*	*79,257*
Total RoW		*33,672*	*24,908*	*13,697*	*43,671*
o/w Digital Learning		***63,613***	***54,334***	*29,873*	*14,767*
o/w MyHR Digital Learning Courses		***23,319***	***7,101***	*6,478*	*4,954*
Digital Courses Completed in MyHR	#	43,513	19,476	16,450	18,175
Health & Safety	% of total learning hours	38.7	43.2	45.0	54.0
Technical Skills		48.4	45.5	39.0	32.0
Soft Skills		1.5	6.5	8.5	8.0
Languages		2.8	3.3	3.8	5.0
Ethics & Compliance		8.7	1.4	3.7	1.0
Total Employees Trained		**8,924**	**8,699**	**7,898**	**8,950**
Employees accessing MyLearning	#	**10,026**	9,850	3,449	2,518
Exempt Employees (1)		1,233	1082	1077	1036
Non-exempt Employees (2)		8,793	8,768	2,372	1482

(1): Including 96 managers of Aperam Recycling
(2) Including 59 Utica USA employees of Aperam Recycling

> In terms of topics, H&S training is always a high priority, representing 38.7% of the total number of hours. Training on technical skills continues to increase in importance reaching 48.4%, as we are investing in Technical areas, such as Châtelet with the "Technocampus", a parity organisation for specialised technical training in the Charleroi region, or Brazil with the process and metallurgy of electrical steels. Ethics & Compliance training has significantly increased to 8.7%.

■■■ To illustrate the focus on technical training, let's turn to Aperam South America.
The Maintenance Academy project, as a pilot model in the Industry, aims to develop and retain critical Maintenance knowledge, mitigating the impacts on the business due to renewal and loss of professionals. The project has 3 fronts, Mapping and retention of this critical knowledge reverted into training of Maintenance professionals through digital and asynchronous pilot. To continue in 2023 : Definition of an on-the-job system to transfer knowledge, via tutoring (in practice), creation of learning spaces so that the operational team has the infrastructure to carry out the digital learning offered.

Voice

"The integration of Aperam Recycling (formerly ELG) not only involved organisational and cultural changes, but also the implementation and harmonisation of processes and IT tools.
Working within Aperam Recycling, I was able to get first hand experience with the many benefits offered by our global HR Information System, myHR.

Through this common platform, we can create global synergies and, for example, offer employees targeted and cost-effective training and education. We can also agree on and communicate goals, as well as moderate and document the continuous feedback process between managers and employees. In this way, we create a reliable database for employees, managers, management and shareholders that is updated daily and enables efficient and sustainable corporate decision making.

We are proud of what we have achieved so far and look forward to the next steps!"

Timo Kißmer
Global HR Specialist C&B and L&D, Aperam Recycling

One of Aperam Recycling's scrap yards (ELG Duisburg).

Jimmy, Manager Cold Rolling Plant, Genk, Belgium.

With a PhD in Materials Engineering, Jimmy began his career at Aperam working in the commercial department – a role that saw him travelling to many of Aperam's export destinations, including many Asian countries but also Canada and South Africa.
Building on the broad experience he gained in this role, he soon moved to the Genk production site, first as a member of the executive committee and now as the Manager of the Cold Rolling Plant. *"During my career I have been able to be a part of some great accomplishments, including starting new production lines and developing strong relationships with customers,"* says Jimmy. "*The fact that there are still many satisfied employees and people who have confidence in me is also an important accomplishment."*
These words highlight Jimmy's love for working with people. *"What makes me happy in my work is first and foremost people – both customers and employees,"* he says.

According to Jimmy, people are the key to productivity and business success. *"Everyone can buy machines, but the people who operate them, plan their maintenance and oversee production are what make a thriving and strong company,"* he adds.
Speaking of people, Jimmy stresses the important role that diversity and inclusion play in a company's success – and the importance of being able to work with and manage employees from many different backgrounds. *"Diversity cannot exist without inclusiveness, and that means paying attention to differences, respecting them and integrating them into a company's operations,"* he says. *"By embracing diversity, you also encourage creativity, which can lead to innovation and long term development."*

For Aperam as a company, Jimmy only sees advantages in continuing to become more diverse. *"We want to be the most sustainable steel producer in the world, become carbon-neutral, and be even healthier and safer,"* he concludes. "*In my opinion, all of this requires having a diverse workforce of employees who all feel included in the Aperam family."*

Tips to newcomers:
"If you take the initiative, you can build a great career within Aperam.
- Don't be blind to the problems that come your way, try to tackle them directly.
- And finally, listen to your heart, try to discover what makes you personally happy in your job and let that influence your career choices.

This is not always easy and it takes time, so be sure to take the time needed".

The impact of ResponsibleSteel™

"Becoming ResponsibleSteel™ isn't the finish line - it's an important first step to further increasing our responsibility, for the environment, for the communities in which we work and for all the people working at Aperam."

Pedro Góes Monteiro
Executive Manager of Compensation & Labor Relations,
Aperam South America Human Resources

Quality of life at Work

Employee Engagement & Communications

Direct and regular engagement with our teams has always been an important part of Aperam's Leadership style. It is also something that we check regularly within our routines and surveys, both within MyHR, and via our Global All-Employees Climate Survey.
Regarding Employee Surveys, the last one was announced in October and implemented in November, 2022 and, for the first time, to all employees including our colleagues from ELG and all blue collars including in China and India. The results have been extensively used since then to adjust action plans at local and central levels. For the first time, all managers had direct access to the results of their teams. A high participation rate : 77% ! See next page for more information.
Regarding local engagement modes, they can take very various shapes, from quarterly info sessions gathering all employees in our main offices or smaller S&S units, down to large meetings repeated several times to allow the shift workers to participate in turns in some of our main units.

■■■ In France, a new agreement negotiated at the end of 2021 and applicable as of January 1, 2022 was signed with all the social partners. This agreement integrates a special focus on: the prevention of psychosocial risks ; teleworking ; the prevention of professional risk factors and mental health ; and of all forms of harassment.
The additional resources and tools associated with this new agreement include specific budgets to improve working conditions, both in terms of ergonomics and social facilities and a system of end-of-career adjustments to take into account any exposure to hardship factors. Finally, the deployment of two surveys on psychosocial risks is also planned during the 4-year period of the agreement, in addition to the company-wide employee climate survey. One of the measures is a specific set of conditions allowing people to benefit from adjusted working time (part-time), allowing them to leave the company earlier, before the normal retirement date, and to receive additional days depending on their exposure to risk factors. Another one promotes home office.
In 2022, some 25 people applied to this progressive early retirement system and more than 100 entered into home office agreements.

Take-aways from 2022 All-Employee Climate Survey

> At a global level, all genders together, our strong point remains the attention we give to Health & Safety. Many initiatives have been deployed this year across the sites, such as the Ergonomical & Sanitary Action Plans or the development Towards a Learning Culture on Errors. 78% of employees feel that they are given the opportunity to actively propose and participate in Health & Safety initiatives and 85% employees feel empowered to stop work or tasks if any unsafe conditions are detected.

Other strengths are:

- **Client focus**: The Climate Survey also reflects our strong customer focus and our commitment to quality: more than 8.1 out of 10 of you believe Aperam actively tries to understand external customers' requirements and expectations.
- **Career and Development** - See page 25: Aperam is a company that values people. To invest in your future, and since 80% of employees want to acquire new skills to further develop their career, Aperam will keep increasing its broad learning offer: roll out the MyHR Learning Platform to all employees, new Business Learning Academies, active use of Coaching and Mentorship as development tools.
- **Diversity** - the 3 new questions on diversity have a score higher than 8/10. See page 20 and following

> Our main developments points are :

- **Mental Resilience and stress management:** see page 17 and Alexandra's quote
- **Communications**, including open and honest communication: Our main focus remains on two-way communication by direct managers. This means managers should spend time on communicating and listening: 68% of employees think that Management generally understands the problems they face on their jobs and 82% think that the immediate manager is available and accessible when they want to talk or need help.
- **Career perspective and development:** We are still facing challenges to find internal candidates for many roles. We will start a new campaign to promote the Aperam Career Portal and the local job boards (only 74% of employees say they are aware of other job positions at Aperam).
- **Performance management**: Almost 40% of employees believe that their management should use non-financial ways of recognizing their work more often.
  In line with benchmarks we also see that around 40% of employees believe that their pay is not at the riht level. Aperam has already implemented different practices to increase clarity on its remuneration systems, this includes training of management employees on the Compensation Policy, communication of personal Hay grades (that are the basis for job evaluations and salary benchmarking), bonus brochures and regular updates on bonus performance, etc.

In order to financially recognize our talents' performance and value, Aperam aligns its Compensation & Benefits policies by comparing them with the practices on the market. We will continue to provide more clarity on our remuneration and job evaluation systems.Non-financial recognition is mainly a concern in Europe where managers' training will focus on recognizing good efforts, giving regular feedback and celebrating successes.

> For the next climate surveys, we aim for a participation rate of 80% (77% in 2021 and 2022) while keeping the sustainable engagement score higher than 8/10 (7.8 /10 in 2022).

Target

80 %
Participation & Sustainable engagement rates

Voice:

"The primary aim of our Climate Survey is to measure and understand our people's level of engagement and the improvement actions that can be taken. The annual survey takes place during the last quarter, which lets us evaluate the year's overall performance and identify any new points that need attention.

Many actions have already been implemented, and new ones will come following our 2022 survey. For example, in 2023 we will, for the first time, conduct a specific survey about mental health and well-being at work. Covering all Aperam employees in Europe, this survey will help us implement actions to even better identify, prevent, act and react!"

Alexandra Arblay
Manager, Health, Diversity and Inclusion and Employee Engagement
Aperam Europe

Elodie, Production Consumables Manager, Pont de Roide, France.

Elodie first joined Aperam as a sales assistant at our Pont de Roide, France plant – a position that saw her working not only in customer relations, but also collecting and analysing sales forecasts.
"*From day one, my job involved industry, technology and multilingualism, along with opportunities to work with internal and external contacts,*" says Elodie.

Although Elodie briefly left Aperam after five years in the sales department, the company's culture was always top of mind. "*Aperam gave me every opportunity to fully integrate into the company, both through access to technical training to improve my sales pitch and through a range of teambuilding activities like a running club,*" she says.

That's why, in 2016, she re-joined the company, this time as a management assistant, a role that saw her overseeing a wide range of tasks, including travel coordination, internal communications, event organisation, and social activity planning. *"I loved being able to do a little bit of everything, all of which helped build team cohesion and enhance the quality of life-at-work for everyone,"* adds Elodie.

In 2019, Elodie jumped at the opportunity to retrain as a production consumables manager. *"It was a challenge to fit in as a female in an all-male team, especially since most of my team members only knew me as a secretary,*" she recalls. Despite this challenge, Elodie says she had no problem quickly integrating with her new team. *"I think it';s perfectly possible to combine life as a woman and a mother while developing your career at Aperam,"* she says.

Elodie's embracing of new challenges has inspired other women to follow suit. In fact, a female colleague has already joined the department as a manager in the rolling sector.

Tips to newcomers:
"Don't be afraid to impose your own style, have faith in yourself and constantly nourish yourself with the knowledge of the people around you."

New work patterns/Work Life balance

To improve the local Professional/Personal life balance, some units can be very innovative.
■■■ In March 2021, further an extensive study on the home office adaptation in times of lock-down, an ad-hoc organisation was formalised for our main office site of Saint-Denis, integrating rotations between home office and physical attendance as the future permanent routine.
> While reducing the surface rent, this new way of working allows more agility, and gives more flexibility to employees to organise their lifetime. The new organisation is based on a minimum of two days of home office and pays special attention to the enhancement of teamwork. Specific accompanying measures have also been defined to ensure the prevention of isolation, develop exchange times between colleagues and management, and provide material support for an optimal home office experience.
> After several months of implementation, a questionnaire was shared with the teams at the end of 2021, which showed that the workspaces meet the needs of employees by alternating physical presence and homeworking, and also allow for times of conviviality with the development of informal events such as environmental challenges, sportive events or video game night.
Due to the 2021 COVID developments that led to necessary adaptation, we really saw the full effect implementation in 2022. According to the Climate Survey and direct feedback of concerned employees, there is a good overall satisfaction with the operation and the support methods. In addition, the home office has been confirmed in the new Quality of Life and Working Conditions agreement in France, in force since January 1, 2022, where more than 100 employees have signed up for this scheme.

The impact of ResponsibleSteel™

"This was really a project that was carried out during the year, which brought us enormous knowledge regarding sustainability, people, society, human rights.
I am happy to have participated to leave this legacy for Aperam."

Paulo Dias Soares
Aperam South America Improvement Program Analyst

2022 Recognitions

Employee care is a long-term priority for Aperam!
> In Europe, for the sixth year in a row, Aperam was ranked amongst the best employers (4th in 2022) within Heavy Industry and Materials by French Capital Magazine.

> In Brazil, Aperam BioEnergia achieved the third championship of the "Incredible Places to Work" 2022 award among the Agribusiness companies. In the Steel & Mining sector, Aperam South America was rated second in a consistent result, the same since 2019.
The "Incredible Places to Work" award considers the results of the annual FIA Employee Experience (FEEx) survey, which establishes indices for organisational climate, people management, leadership, and CEO popularity and management.

Our Planet

Our plants use immense energy and hazardous substances to transform recycled and raw materials into the precise blend of Alloys required by our clients. In turn, these Alloys can be used to make affordable, long-lasting and sustainable products, including energy-efficient buildings and low emission vehicles.

Although Aperam is an industry leader in sustainability, our new 2030 milestones for energy, CO_2, air and water, show our commitment to minimise our impact on the environment - and on our neighbours. We are proud of our state-of-the-art CO_2 footprint and of our action plan to reduce it further and contribute to global carbon neutrality, with a net zero footprint (scopes 1+2) by 2050.

Our Vision and Organisation

Organisation

During 2022, amid the energy crisis in Europe, we have accelerated our programmes aiming to reduce our specific energy consumption and CO_2 emissions. We adapted our organisation for a greater coherence to our actions to mitigate our environmental impacts, particularly those arising from Greenhouse Gas emissions. As part of that, the position of Chief Sustainability Officer has been created within the CTO organisation, with responsibility for environmental management, industrial risks and the Energy/GHG action plan.

> At the end of 2022, a portfolio of over 100 projects contributing to our 2030 Greenhouse Gas emission reduction plan (-30% GHG scopes 1-2 and -11% energy consumption - base 2015) was monitored in close collaboration between local operations and the CTO team.
- Each production site has one or two engineers dedicated to the feasibility studies of energy/CO_2 projects, from the idea to the preparation of the investment file. When accepted, the implementation is carried out under the guidance of the local engineering department, with possible support, in terms of resources, from the CTO team. All the engineers exchange on a monthly basis about the ongoing projects in order to ensure knowledge sharing and swift implementation of proven techniques in all the group's plants.
- The governance of the management of this project portfolio is based on monthly steering committees in each plant, the main purpose of which is to ensure that the objectives and priorities are perfectly aligned between the various stakeholders.

> In terms of environmental management, the partially centralised organisation aims to promote collaboration between the various managers from different locations and to optimise investments by giving priority to the projects that allow the greatest progress to be made within the framework of a multi-year plan.

Main 2022 evolutions

> 2022 is the year of the integration of our new Aperam Recycling division. While this integration is adding CO_2e emissions on our Scope 1+2 emissions (16.7kt of CO_2e in 2022), Aperam is keen to keep its original target set for 2030 and 2050. 2022 was also the year in which we organised our first Sustainable Development Week (see p. 44), further deployed our biodiversity program (see p. 43), and showed important progress on the group dust emissions (see p. 37). All this while continuing to work towards our other 2030 and long-term objectives and promoting the virtues of the circular economy.

> During 2022, we decided in addition to our climate change report to CDP to add the water security report. We earned a “B” rating for the first year and see this rating as a recognition of all the efforts our teams are doing to improve the use of the water resource.

Voices

“While integrating the new recycling business, the CO2 objective for 2030 remains the same. This is a strong message demonstrating our commitment to reduce to its maximum our scope 1+2 CO2 emissions.

Regarding scope 3, a first assessment of our scope 3.1 is disclosed in this report. It is part of the SBTi-compliant roadmap that we build for Aperam Scope 1+2+3 emissions towards 2030 and 2050.”

Laurent Piranda
Head of Environment & Industrial Risks

78% of employees consider **Aperam environmentally responsible**

*Data highlighted with a star have received external assurance.

Voices

The clock is ticking to preserve our Planet as an environment where mankind and nature are able to prosper for many generations to come. Aperam is committed to play its societal role to contribute to this worldwide challenge. We know that we make a product which will play an essential role in this future world, thanks to its lifetime and its endless recyclability, but also thanks to the way we produce it.

We are on a clear roadmap as a company, taking many small and big steps towards a leading role in the circular economy of the future. And we will continue to innovate and find new ways to further and faster reduce our scopes 1, 2 and 3 CO_2 footprints, and minimise our global environmental impact.

Bernard Hallemans
Aperam Chief Technology & Sustainability Officer

Our Environmental Performance

GRI 305-4, 305-7, 302-1, 302-3, 303-2, 303-3.

Indicator	Unit	2030 targets	2022[4]	2021	2020	2015
Energy: Elec + Nat. Gas + LPG	GJ/tcs[1]	6.9 (-11% vs 2015)	8.0*	7.8*	7.7	7.8
Energy: All	GJ/tcs[1]	n/a[2]	13.2*	13.2*	13.3	12.0
CO_2 sequestration	ktCO_2e	n/a	(412)*[5]	(467)*	n/a	n/a
GHG emissions (net) [3] (B")	tCO_2e/tcs[1]	0.30	0.32*	0.34*	n/a	0.54
Dust emissions (exhaustive)	t	n/a	210*	327*	298	521
	g/tcs[1]	75.7 (-70% vs 2015)	107*	155*	152	252
Recycled Input in Production	%	n/a	29.1	28.2	25.4	30
Wastes to landfill	kt	Zero Waste for Landfill i.e. 100% Reused/Recycled	108.5	110.7	87.6	103
Hazardous Wastes			30.0	32.3	25.04	36
Non-Hazardous Wastes			78.5	78.3	62.55	67
Reuse Rate	%		92.4	92.9	94	93.5
Water Intake	million m^3	n/a	21.1*	21.7*	22.8	22.1*
	m^3/tcs[1]	6.1 (-40% vs. 2015)	10.8*	10.0*	11.8	10.2
Water Recycling	%	n/a	96.02	95.8	95.3	95.4
Water Discharge	million m^3	n/a	16	17	16	15
Suspended Solids in Water	t	n/a	225	307	146	204
Metal Discharge in Water	t	n/a	7	7	9	6

*(1) Ton of crude steel, 'all tons', i.e. including 'purchased tons' - **For more information, see Supplement D - Methodological Appendix**.*
(2) 2030 objective scope limited to electricity, LPG and natural gas only.
(3) GHG emissions net of CO_2 removals (sequestration) operated by our Brazilian forestry.
(4) Including Aperam Recycling, the new Segment within the Aperam recycling & Renewables, which was built upon the recently acquired ELG business.
(5) For 2022, calculated based on a carbon stock computed in light of the updated native forestry categorisation (based upon more advanced satellite imagery) and the latest (2022) updates of the reference database (United States Geographical Survey, USGS).

> In parallel, we continued to report monthly to the management and to review, upgrade and complement our main indicators, allowing us to react quickly if one is off track. This was also done taking into consideration the new requirements of the EU taxonomy (see p. 36). To enhance our global efficiency, particular attention was also provided in the development of information systems both to optimise our performance monitoring consolidation process (and integrate the new Recycling units) and also to efficiently report incidents and anomalies. The benefits of this work will only be fully apparent in the course of 2023.

Incentivization for Further Progress

For a few years now, the CO_2 performance has also been incorporated into the individual objectives of the management, ensuring a focus at the highest level of the organisation.
Other incentivization initiatives are not excluded as Aperam's management is convinced that water for example is very precious to protect. We launched during 2022 an internal study to review the impact of climate change on the water resource, and this is followed in 2023 by a large project on climate change risk.

Industrial Footprint

Energy and CO_2

A Key Responsibility

The steel sector is one of the world's biggest greenhouse gases emitters. This is the result of both the industrial equipment it uses, which is designed to reach temperatures of over 1600 °C to melt iron ore or scrap, and the chemical necessity of adding carbon to iron ore in order to produce steel.

Despite operating in this heavy industry, Aperam maintains a best-in-class carbon footprint, the result of three key factors. First, our European electric arc furnaces predominantly use scrap metal instead of mined raw materials (see p. 39). Second, on top of operating energy efficiently, we also use a low-carbon energy mix (see p. 35). Last but not least, and this is really unique in our sector, Aperam can also be considered an agricultural company, operating over 100,000 ha of FSC®-certified forests in Brazil.
We use our forests to produce our own charcoal, which we then use as input in our steelmaking process as a natural and renewable substitute for fossil fuels (coal based coke). Unlike many of our global competitors, this allows us to entirely eradicate the use of extractive coke in our blast furnaces and makes our steel more sustainable.

Forests and Carbon Offset

From the careful genetic selection of the sapling to planting, maintenance and harvesting, our forest is continuously cultivated and maintained according to best practices in sustainable forestry. We manage this forest as a precious asset, ensuring the protection of biodiversity and respect to the environment, and we regularly win awards for these practices.

- The cultivated forest is managed in a way that increases the density of the wood per hectare. This is thanks to the species we plant, which are more efficient (less water and fertiliser needs, enhanced resilience to pests) and more dense than the species previously planted. This change was made based on the genetic improvement of our research and development laboratory.
- Our saplings are recognized for their quality in Brazil.
- The native (non cultivated) forest is managed in a way that respects the natural species and biodiversity (including pollinators). To do so, we replant where needed.
- As fire is a risk, we actively track and fight any possible fire using viewpoints, camera monitoring, drones, and other technologies.

> After harvest, BioEnergia sends the trees to kilns, where they are turned into charcoal (biomass), known as "bio-coal" locally. This forest is factually carbon negative, meaning it acts as a carbon sink. Our parcels stock CO_2 in the cultivated areas, in the trees and in the soil where leaves degrade into humus. The same can be said for the native forest areas, which are conserved in accordance with local regulations and to the benefit of local biodiversity.
> The annual carbon sink improvement of our forest depends on the planting strategy rollet out 5-8 years ago. Therefore, the carbon sink is not stable year-on-year. Until we achieve our 'cruising speed' in terms of density and carbon capture, some years may even see a decrease in the carbon sink. That being said, we are happy to confirm that our forest management brought a carbon offset of 412 kt in 2022, which is less than the 467 kt offset in 2021, the result of the lower planting done half a decade ago.

Aperam BioEnergia 's carbonization unit with the 100,000 ha of FSC®-certified forest in the background (Minas Gerais, Brazil).

Refining an Already Best-in-Class CO_2 Performance

Since 2017, our CO_2 footprint intensity has been constantly at the vanguard, well below the industry standard, with the latest WorldStainless's average being at 0.88 tCO_2e/tcs in 2019, according to the Association's 2021 General Meeting. While we record a best-in-class performance, maintaining it requires constant efforts and 2022 saw the launch of substantial works for the next phase of our decarbonization (see next pages).

> On top of the energy pillar of our program (see p. 35), we are investigating other strategies. As part of this, we now yearly assess both the emissions and the sequestration achieved by our exceptional forestry management (see above), as well as those linked to our conservation program (Oïkos). While it impacts our Scope 1 emissions "(a)" - mostly from methane (CH_4) emissions during the wood carbonization process - this new methodology allows us to report massive carbon captures in "(c)", thus bringing a complete view of our impact, now consolidated in absolute value in "(B) Scope 1+2 net".

As a result, we report the following detailed figures, in absolute terms as well as in intensity.

GHG emissions (GRI 305-1; 305-2; 305-4)

Absolute values and intensities, by scope	GRI	Unit	Target 2030	2022 Full Scope	2022 2021 scope
(a) Scope 1 - Non-Biogenic (absolute value)	305-1	$ktCO_2e$	n/a	807*	796
Scope 1 - Biogenic (absolute value)	305-1	$ktCO_2e$	n/a	945*	945
Scope 2 (absolute value) location based	305-2	ktCO2e	n/a	243*	238
(b) Scope 2 (absolute value) market based	305-2	ktCO2e	n/a	217*	212
(A) Scope 1+2 gross (absolute value: a+b)	n/a	$ktCO_2e$	n/a	1025	1008
(c) Sequestration (absolute value)	n/a	$ktCO_2e$	n/a	(412)*	(412)
(B) Scope 1+2 net (absolute: a+b+c)	**n/a**	**$ktCO_2e$**	**n/a**	**613**	**596**
(A') Scope 1+2 gross intensity (own tcs): (A)/tcs	305-4	tCO_2e/tcs	0.37	0.53*	0.52
(A'') Scope 1+2 gross intensity (all tons): (A)/tcs	305-4	tCO_2e/tcs	0.37	0.53*	0.52
(B') Scope 1+2 net intensity (own tcs): (B)/tcs	n/a	tCO_2e/tcs	0.30	0.32*	0.31
(B'') Scope 1+2 net intensity (all tons): (B)/tcs	**n/a**	**tCO_2e/tcs**	**0.30**	**0.32***	**0.31**

*Data having received external assurance.

Besides, the variation in the volumes (mostly slabs) purchased from the market to further transform them and increase our sales can have a significant impact on our metrics. So, last year, we decided to avoid distorting our ratios by adjusting the emissions "as if" we had melted ourselves these tons (adding fictive emissions) in the numerator and not only considering our "own" tons of crude steel ("own tcs") but "*all* tons" (i.e "own + purchased") in the denominator. We believe this methodology gives a fairer view in so far as our performance is more comparable year on year - and also in view of competitors'. Again, we present both fractions (B' and B''), for the sake of full transparency, but **the one reflecting our performance will be the B''** ("net CO_2e intensity - all tons"). For more information on methodologies, please check the Appendix D.

> Using our *"all tons"* methodology (line B''), **our 2022 emissions are 10% lower than in 2021** on the same scope, i.e without Aperam Recycling. This is mostly due to two reasons:

- On scope 1, we continued the installation of CH_4 burners on Bioenergia carbonization units and proved their 100% efficiency, thus reducing drastically our methane emissions ;
- On scope 2, almost 15% of the improvement comes from better grid emission factors in addition to the benefit of an increased on-site green energy production (see our achievements in Belgium, page 35).

Overall, in 2022, our Brazilian forest management is bringing a partial offset of our local emissions and the impact is also significant at Group level : **using our indicator B'' corresponding to the CO_2e footprint of Aperam (full scope), we report a 0.32 tCO_2e/tcs.**

As our most impactful projects have not started, Aperam is on track to achieve its CO_2e 2030 objective of -30% vs. 2015, which stands at 0.30 tCO_2e/tcs taking into account all our new methodological updates introduced last year (check the Appendix D).

CO_2

0.32 tCO_2e/tcs

Leading footprint in Stainless

Our 2030/2050 Targets and Roadmap

Despite the integration of the Recycling division and the inclusion of new emissions from 2021 (eg. biogenic methane out of our charcoal kilns), we maintain our ambitious 2030 target unchanged (gross scopes 1 and 2). At iso-methodology, it represents an improvement much more ambitious than the 30% announced initially (base 2015).

Our net intensity target is very close to our current result and we should do better. But, taking into account the variation of the forest carbon offset and the evolution of the volume of production, we remain cautious. As soon as we will disclose an objective including scope 3, we will reassess our objectives as we now believe we might go faster on our de-fossilisation roadmap.

In the meantime, we continued our efforts, during 2022, to get on speed our projects on :

- Energy Efficiency, incl. Heat Recovery.
- Investments on high efficiency ladle burners at meltshops.
- Ongoing $HECO_2$ project with other industrials (electrification of heating and carbon capture in the Meltshop).
- Carbon-free fuel/energy, incl. NG substitution, Solar and Wind.
- CH_4 emission reduction from our charcoal kilns (burners).
- Variable speed drives and oxy combustion.

Although there is a long way to go, we are on track to achieve our 2030 and 2050 objectives.

Scope 3 and total carbon footprint

Reporting on Scope 1+2 is key, as our primary responsibility remains to minimise the impact of our own process, but considering the full picture is also paramount for the decarbonisation of the economy. A total CO_2 footprint aggregates a company's emissions (scopes 1+2) with those emitted upstream of the process (called "scope 3a"[3], it covers all production input, from raw materials to travel and computers) and the downstream footprint ("scope 3b").

> For stainless products, the weight of the CO_2 emissions related to upstream processes, particularly those linked to the extraction and refining of primary raw materials (scope 3.1, category "purchased goods and services") is paramount. That is why, for our sector, the most pertinent comparison shall rely on a footprint scope 1+2+3a.

As an example, even if our energy-intensive Recyco unit acts as a recycled material supplier, it is an *internal* supplier, therefore its CO_2 emissions are consolidated within our (Scope 1+2) footprint - not in our Scope 3. The same now applies to our Recycling segment.

> For 2022, we report a global scope 3a at a level of 3.83 $MtCO_2e$/ton, of which the scope 3.1 is 3.35 $MtCO_2e$. Our global Scope 3a intensity reaches a level of 1.985 tCO_2e/ton. Without sequestration, the global Aperam footprint (scope 1+2+3a) is 2.5 tCO_2e/tcs - and with sequestration, it stands at 2.3 tCO_2e/tcs.

> Our (scope 1+2) footprint is already best-in-class but considering our high usage of stainless steel scrap in Europe and the fact that we use no extractive coke in Brazil, our raw materials footprint is much lower than the sector's average: according to our certified Environmental Product Declarations (EPD), i.e. using normative emission factors, our scope 3a emissions (upstream, from cradle to site entrance) could range from 1.29 tCO_2e/ton (304 products) to 1.68 tCO_2e/ton (K41 KARA) for the products made in Europe and this is a preliminary estimate. **We evaluate[4] that the CO_2e emissions per ton for stainless steel made of extractive raw materials is up to five times higher than ours.**

To improve our estimate, our teams are striving to collect more specific data in relation to the raw materials purchased from our main suppliers.

> A first plan is already established to reduce Aperam's scope 3a by a double digit percentage by 2030. This is seen as a starting point and more will be developed to achieve our 2050 target. Our average nickel input footprint is clearly below that of Nickel Pig Iron (almost 60 tCO_2e/t of Laterite - matte via NPI -, according to the IEA, May 2021), but we are continuing our efforts with our suppliers to further decrease this impact.

While developing technologies to increase the supply of environmentally friendly nickel with our Botanickel joint venture company (see p. 46), we are actively working with our suppliers who are responsible for over 70% of our scope 3.1 emissions. This is a long journey since our suppliers also need to find out their total CO_2 emissions to be able to provide a robust roadmap with objectives for 2030 and 2050.

In 2022, our estimated scope 3.1 was 3.35 $MtCO_2e$, representing 87.4 % of our scope 3a.

[3] All emissions (scopes 1+2+3) related to the production inputs used by our activity, including consumables, assets and the related transportation (8 categories of products and services) before they enter our sites. Scope 3b refers to the downstream emissions, including the transportation to the user and energy consumption during the product's usage.

[4] Aperam estimates & calculation, ISSF data, CRU.

The girders of the Brides les Bains footbridge are made of Aperam 304L stainless steel, with a Uginox polished mirror reflecting the eddies and movements of the water. The footbridge thus changes with the seasons and the weather, and allows for discrete integration into this alpine environment.
Footbridge of Bride les Bains, France - Nu Architect © Cyrille Lallement, Aperam 304L Uginox Meca 8ND®

Voices

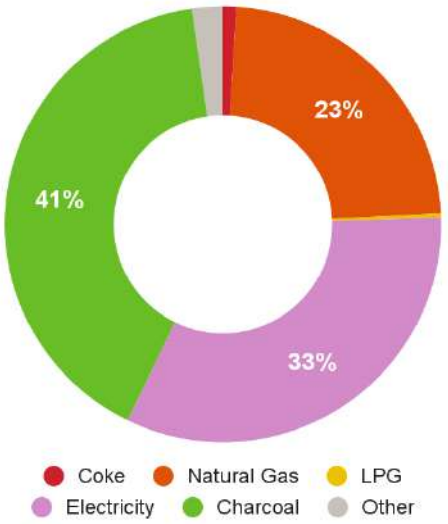
"At Aperam, we are committed to concrete results, implementing more than 100 actions aimed at increasing our energy efficiency, recovering waste heat and replacing our fossil fuels with low carbon or renewable energies.
We are on track to achieve a reduction of our CO_2e emissions per ton by 30% in 2030 compared to 2015, with the ultimate goal to achieve carbon neutrality at group level before 2050, after taking into account sequestration efforts such as those carried out in a masterful way in our forests in Brazil.

In parallel, biodiversity clearly plays a major role in our economies and our lives in general, as the epidemics recalled. As many of the solutions to mitigate Climate Change or its effects will come from natural environments and the services they provide, biodiversity promotion is part of our plan too! See our efforts p. 43."

Carlo Morettin
Chief Sustainability Officer

Aperam 2022 Energy Split (%)

GRI 302-3



Inauguration of Genk solar park in May 2022.

Energy

50% Renewable energy

2022 performance

+2% vs. 2021

Mix Effect

Our energy intensity depends on the metallurgical blend we produce, as not all metals melt at the same temperature. Furthermore, when we "sophisticate" our products during downstream operations, such as when we give them a bright surface finish or transform them into tubes, wires or tiny precision strips, we use more energy than what is used to produce semi-products. However, the volume of initial crude steel remains unchanged, which impacts ratios and apparent performance displayed in terms of energy intensity...

This means that comparisons are only valid between similar products!

Energy Mix and 2022 Performance

Despite ongoing efforts, Aperams reports 13.2 GJ/tcs or 3.7 MWh/tcs (including purchased tons, see Supplements for details on our methodology (GRI 302-3, 302-4)) which represents a 0.75% deterioration in energy efficiency over 2021.

Nevertheless, we remain on track to achieve our 2030 target of an 11% reduction in energy use (base 2015). In 2022, the energy efficiency has been impacted by the integration of Aperam Recycling division and by the decrease of the production.

The lower production volumes coupled with mix effects and several technical issues in some plants led to hide the benefit of actions implemented in 2022 to improve our energy efficiency (e.g. Electric Arc Furnaces, reheating and annealing furnaces efficiency, LED lighting,...).

> On the energy mix side, ours remains a subject of pride, with 41% coming from charcoal biomass (see aside, +4 pts last year - taking into account the share of our electricity generated from renewable sources). As for electricity, in 2022, our global carbon footprint decreased in our main countries of operation. In addition to lowering the emission factor of our electricity suppliers, several other actions have also had a positive effect (even if it is partial in 2022). These include major solar panel projects (30 MWp in Belgium).

■■■ In Belgium, where our biggest European steel plants are located, we have a major programme to turn to solar energy.

> The 50,000 panels installed in Genk (left) started providing green electricity to the site at the beginning of 2022. Almost 20 GWh were produced during the year, covering nearly 5% of the site's electricity needs. We are investigating how to increase this capacity. We are also installing LED lighting, which helps save an additional 6000 MWh annually.

Windmill and photovoltaïc panels at the Genk (including the parking area).

> A similar project was implemented at our Châtelet plant. At the end of 2021, we investigated how to best turn its roofs into a solar panel park. After an intensive study, suitable locations for the solar panels were identified, based on stability and sunlight. The study resulted in a photovoltaic project with more than 15,000 panels installed on a total surface of 4.5 Ha. The complete project results in an installed capacity of 6.9 MWp and an expected annual production of 6,300 MWh of green electricity .

The first green MWh were produced on July 1st, 2022, with production reaching 2860 MWh by the end of the year.

Almost 100% of the energy produced is consumed locally, on our site, which means injection into the public high-voltage grid shall be exceptional. This allows us to reduce our CO_2 emissions by approximately 1,000t/year. The related production of green electricity corresponds to the average electricity consumption of 1,750 Blegian households. On top of this, to accelerate the greening of our vehicle fleet, 100 additional charging stations will be installed in 2023.

Photovoltaïc panels on Châtelet roofs.

The EU Taxonomy: Aperam' Climate Change Mitigation Activities

Aperam's steel operations and, due to analogical rationale and usual business practices[5], our alloys and specialties business all fall under Economic Union Taxonomy regulation's sectors 3.9 - Manufacture of iron and steel and 5.9-Material recovery from non-hazardous waste (covering the activities of Aperam Recycling).

> In 2022, we conducted a thorough analysis that included verifying our main units' compliance with relevant substantial criteria. The specific criteria used were direct GHG emissions generated by our steelmaking units' production of hot metal, calculated according to the methodology used for EU-ETS benchmarks. In order to include EU Taxonomy results in our Annual Report, which was published on March 28 2023, we used 2021 data as the 2022 data had not yet been verified. The applicable criteria for Aperam Recycling activities was the 2022 rate for the weight of converting the separately collected non-hazardous waste into secondary raw materials.

We also analysed our main units' alignment with the EU Taxonomy Do-Not-Significantly-Harm (DNSH) criteria and Minimum Safeguards, based on 2022 information and any operational incident reported.

As pre-announced within our Annual Report's Taxonomy section, we can now confirm, based on 2022 verified direct GHG emissions, that that Aperam's activities that are aligned with the EU Taxonomy represent 81% of 2022 turnover, 76% of 2022 OpEx, and 61% of 2022 CapEX of the Aperam Group. Our 2022 verified GHG emissions had a plus or minus 10% gap compared to the initial assumption (2021 emissions). This means the margin of error is quite negligible compared to the margin of manoeuvre to the "Mitigation" GHG thresholds, which stand between 25% and 95% higher, depending on the unit considered. This also means our internal methodology based on (Y-1) data provided reliable information.

> In the end, the final results with respect to our Group's EU Taxonomy alignment are fully in line with the results of our preliminary analysis disclosed as part of our Annual Report (including table in Appendix I of the Annual Report, p. 107) and based on 2021 verified data.

2022 Group Activity[(1)]	EU Taxonomy Eligible	EU Taxonomy Aligned	EU Taxonomy Not Aligned
Turnover	100%	81%	19%
Capital Expenditures	85%	61%	39%
Operating Expenditures	94%	76%	24%

(1) Based on 2022 verified CO_2e information.

[5] In the absence of a unique definition of steel and ferro-alloys, our analysis is based on the proximity of classification between Alloys and Stainless Steel activities, both being covered by the EUROFER association under one single "stainless & specialty steel" category next to "steel" and considered by the regulator as being subject to the same rules and norms, in particular the National permit procedures, the European Union's Emission Trading System (ETS) and the EU Best Available Techniques (BAT) for Iron and Steel Production. For more, see 2022 Annual Report, p. 104.

The summary table (left) is fully updated and the detailed information is now communicated on our website under the Taxonomy sub-section.

> All our main units used as reference for this analysis, along with the Timóteo plant in Brazil, operate in compliance with their applicable regulation and Aperam's internal standards. Yet the lack of alignment between the requirements defined under the rules of EU Taxonomy (in particular the EU BAT) and those applicable under Brazilian law currently prevents us from confirming our Brazilian operations' compliance to the DNSH Pollution Prevention and Control in 2022. This explains why we cannot report alignment with the EU Taxonomy criteria on this perimeter and why we disclosed a total share of our activity being aligned for 61% to 81%, depending on the financial criteria selected.

> That being said, we are proud to announce that our Brazilian unit is on the right path to ensuring compliance with BAT, a commitment that, when reached, will allow full alignment per EU Taxonomy standards. A first milestone was reached when the unit became ResponsibleSteel™ certified in early 2023, after the full audit process undergone in 2022.

> Please also refer to the Annual Report, section EU Taxonomy, for more information on our methodology.

The Impact of ResponsibleSteel™

"Being ResponsibleSteel™ certified means embarking on a journey that does not set limits and that encourages us to increasingly seek cleaner, more innovative technologies with less environmental impact."

Susana de Castro Alves Moreira
Aperam South America Environmental Engineer

Air Emissions

Local air quality is an important issue for our operations. Our Environmental Policy commits us to a long-term approach to environmental performance and, according to our Stakeholder engagement, dust (particulate matter) stands amongst our most important material issues. In addition to dust, we also produce other air emissions, in particular NOx and SOx, reported for Europe only (see left-hand side).

Because this issue is so important to the local communities around us, Aperam has committed to going beyond what is required by current regulations. Diffused dust is measured periodically to evaluate the leakages and identify areas for improvement. Furthermore, dust falls are also a relevant additional indicator, as it directly reflects the nuisances caused to local populations. But this last metric is impacted by external factors such as wind or alternative sources of pollution (agriculture, traffic, etc.), rendering the interpretation subject to debate. As such, we mostly report ducted dust emissions.
With the aim to change mindsets, improve the reliability of our measurements and ensure that progress is continuous, we have set up an action plan with global Aperam targets. We also started to conduct more frequent measurements and develop more precise methodologies for the assessment of our impacts (See Supplement D). As our previous goal has been achieved (-40% in 2021 in intensity, from 2015 benchmark), in 2020 we announced a new target of a -70% decrease of our ducted dust emission intensity by 2030 (compared to 2015). This objective is to be reached while also reducing diffused (non-ducted) dust. For 2022, the objective is achieved thanks to important changes done in our Timóteo facility, where we added a continuous surveillance system and a capability to do onsite measurements.

Ducting and Controlling Dust Emissions

Our dust emission improvement plans focus on either containing, ducting, or collecting the dust (in Europe, the collected dust is sent back to Recyco for recycling).

> Our “exhaustive” indicator, which provides a good assessment of our impact over the full year based on all the measurements done (not only those reported to the authorities as per our permits ie. two per year and chimney in Brazil), shows a total Group emissions of 107 g/tcs, compared to 155 g/tcs last year GRI-305-7.
> This result is well reflecting the action plans in our Timóteo facility. For the three European meltshops, we have strong improvement programs in place including revised maintenance plans and the set up of more ducting and treatment capacity (like in Imphy, with the EAF 4th hole ducting project). The Timóteo plant being the main contributor to the ducted dust emissions, we launched an engineering study in 2021 to clarify what are the best investments needed to bring our emissions at target in 2030. We took the first actions during 2022 and see already promising results. In the meanwhile, the team is committed to ensure a perfect management of our dedusting assets.

Air emissions

107 g/tcs 2022 dust emissions

Multi-year roadmap

NOx/SOx emissions (Europe only) GRI-305-7

Emissions	Unit	2022	2021	2020	2019
NOx	t	830	830	544	763
SOx	t	54	59	45	37
NOx	g/tcs	426	371	279	381
SOx	g/tcs	28	28	23	18

Noise and Vibrations

Our plants, while being compliant in terms of noise emissions, are continually working to improve any “sound nuisances” perceived around the properties. They are running regular campaigns or are placing sonometers close to the neighbouring houses to identify where the Aperam’s activities have an impact on the global noise environment. In general, any change is an opportunity to improve our impact on people and on the environment.

As an example of this commitment, we would like to highlight the participation of Aperam to a European project called “SILENCE” in collaboration with two Universities, Scuola Superiore Sant'Anna de Pisa (Italy) et Deusto de Bilbao (Espagne), one laboratory and a carbon steel producer.
The project “SILENCE” aims to reduce acoustic emissions impact on steelwork and surrounding communities through the installation of real-time acoustic sensors, coupling modern process monitoring techniques with a KPI’s metric approach. Artificial intelligence tools and machine learning-based analyses application will assess the acoustic performance of the different processes correlating them with process data and meteorological conditions.
The final aim is to give online information and advice to the operators who could act to mitigate the acoustic emissions level. Moreover, strategies will be adopted for suitable training to improve operators’ acoustic sensitiveness. The SILENCE systems will be tested in two plants located in different morphological areas producing carbon and stainless steel, one of which is Aperam Châtelet.

Eucalyptus and Water

Like all vegetation, eucalyptus requires water and nutrients to grow and survive. However, the forests at our unit in Brazil (BioEnergia) are grown using carefully selected saplings which require less water and nutrients and are thus particularly well suited to the unique environmental conditions of Vale do Jequitinhonha, our only unit in a regular hydric stress. Thanks to our state-of-the-art R&D, we will continue working on plant selection to further adapt their water needs and pest resistance.

For more information, visit: aperam.com/sustainability/environment/bioenergia/

Water

At Aperam, our commitment to clean water is an everyday topic and a responsibility to our local stakeholders : this is reflected in the way we monitor our water intake and the quality of our disposal in line with our permits. We aim to intake less water by reducing our consumption and increasing the amount of recycled water we use, which is currently 96%.

> After a global audit program on the water intake at our main sites in 2021, we had to delay the second wave of this water auditing program to 2023-2024 to give priority to our energy management since the situation changed with the energy crisis fostered by the war in Europe. However, during 2022, we launched an assessment on the water scarcity risk at our main sites and a thorough climate change assessment of all our locations (see p. 42).

> One of our main challenges in water intake management is the adaptation of the water use to the level of production. In 2022, we faced periods with lower production levels, due to high competition from imports and energy prices, and we could not optimise the level of our water intake according to the reduced needs (see below). Nevertheless, this is not jeopardising our commitment to achieve the 2030 goal of 6.1 m^3/t.

Water Intakes Trends

After a continuous reduction between 2012 and 2015, we have since then observed a period of stabilisation, particularly in terms of intensity. Here are the detailed results for 2022 :

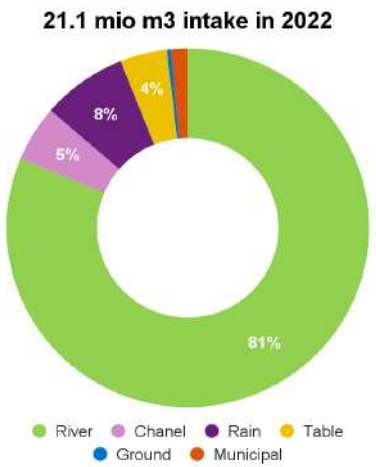
- Total intake in absolute value for 2022 was down by 5% over 2021, but -9% vs. 2015.
- Intakes in intensity (including purchased tons) was up by 8% in 2022 compared to 2021, but +6% vs. 2015.
- 96% of our intakes came from closed circuits (i.e. recycled water), meaning that less than 4% of our water is extracted from the environment.
- Of the 4% of water that we do extract, 81% comes from rivers and 8% from collected rain (GRI 303-3 - see full detail in the graph to the right).
- Most of the water withdrawn is given back to the river after treatment. In 2022 we had a 22% gap between water intake and discharge to the environment.

■■■ Some of our stakeholders complain in relation to the water usage around our BioEnergia forestry, in Minas Gerais (Brazil). We know and regularly meet the local groups concerned, mostly farmers. Their stand is sometimes echoed by media or activists, but it is backed only by partial studies, sometimes involving members of renowned Universities but not conducted and reviewed by the Universities themselves.
Truly, it is quite complex to isolate root causes for drought and rivers' lower levels, with seasonal variations and climate change effects. So, taking the matter seriously, we collected studies from four different State Universities, all confirming that water availability around our plantations is fairly good, compared to other local forests and even more so, compared to some neighbouring areas used by traditional agriculture (pastoralism). This subject is also scrutinised on a yearly basis by external auditors, who do engage with the complaint holders, as part of our FSC© certification.
In 2022, their last conclusions confirmed that they could not find any ground for such allegations against Aperam BioEnergia.
However, we remain committed to engage with our neighbours, discuss any problem and further improve our saplings and practices (see p.37 and 43). Indeed, BioEnergia now only plants during the rainy days -and not during 'the (whole) rainy seasons'-, which triggers quite complicated logistics and scheduling. But we are ready to do our best and will continue to improve! The related total water intake in 2022 was 310.10^3.m^3 i.e. -3% vs. 2021 (GRI-303-3).

Water Disposal Quality

We treat our effluents and monitor our discharge into rivers in line with our permits in terms of volumes, pH, temperature, particles of suspended solids, and metals in water and swiftly react in liaison with Authorities in case of anomaly.

2022 Intake by source (m^3 and %)



2022 Disposal Details

- Total discharge: 16.4 mio m^3 (+2.2% from 2021 excl. Aperam Recycling)
- Metal discharged: 7.04 kg/tcs (-6.0% from 2021)
- Suspended solids: 225.5 g/tcs (-26.5% from 2021).

Water

96% Recycling rate

-40% target 2030

Consumption intensity vs. 2015

GRI 303-3, GRI 303-4, GRI 303-5.

The Impact of ResponsibleSteel™

"We were challenged to think about how we need to manage natural resources in a different way.
Thinking about the lives of people who depend on the river, for example, in neighbouring communities, in nearby cities, and in the future of this river, where we capture the water we use in our production."

Hebert Barros Malaquias
Aperam South America Executive Utilities Manager (Timoteo)

Waste & Recycling

We greatly value our recycling performance. An example of our commitment towards recycling is our Recyco unit, that recovers the metallic content from the melting shop dust. We also produce metals that are endlessly reusable and we use a large amount of recycled materials in our production process. Our acquisition of ELG, now incorporated in our Recycling division, is accelerating our roadmap to become a zero-waste (for landfill) company GRI 306-1.

Recycling of Metallurgy By-products

In 2022, our production of waste decreased by over 6 % versus 2021 due to a reduction of our activity, with 7.3% of our by-products being sent to the landfill, the remainder being reused, recycled or stored for future recycling (see graph, below). Our waste recovery ratio stands at 93% i.e +0.3 pts compared to the 2015-2018 average GRI 301-2.

Less than 8% of our wastes are classified as hazardous. While more than 90% of total wastes are already recycled or re-used, some of our by-products, such as acids or specific treatment mud, are waiting for viable technical solutions. Engineers, R&D and a few external partners are studying the technical solutions to neutralise such wastes. As a consequence, in 2023, we are planning to start a second phase of acid regeneration in Genk to further reduce our acid wastes (see last year's report).

Aperam Recycling yard in Germany.

2022 Residues

7.3% landfilled

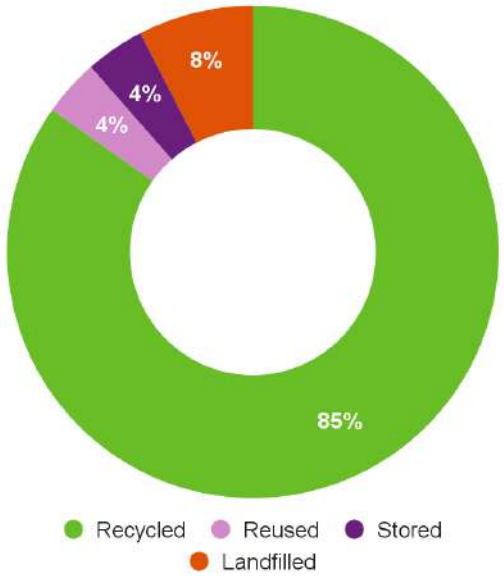
Hazardous < 7.5%

of which

94% reused or recycled

2022 Residues Split (%)

GRI 306-3, GRI 306-4, GRI 306-5.



Genk acid regeneration unit.

Metallurgy as a Recycling Channel

In 2022, 29% of all our material (GRI 301-2, including wooden pallets, refractories, consumables, etc., total input of 4.7 million tons) came from recycled sources. We usually focus on metal scrap, but many other items also come from recycled sources: electrodes, wooden pallets, acids, etc.

> In terms of scrap, we collect our own internal process scraps at each of our units and, after careful sorting, we send them back to our melt shops, usually via railways. We also purchase important quantities of scrap from external providers, all of which must meet specific qualitative specifications (eg. in terms of nickel or chromium content - but also in terms of radioactivity- see next page). The granularity of this scrap is also important as the density of the volume allows us to optimise the loading rate of our own tools within our process.
Contrary to what can be imagined, stainless scraps are predominantly composed of end-of-life scrap. Scrap traceability is complicated due to the blending that takes place at the largest providers to meet the demands by grade and the collection/deliveries that are organised in batches. This End-of-Life predominance also explains why the countries with more recently developed economies do not have a significant and well structured scrap market as it exists in Europe and in North America, for instance.

> On average in 2022, Aperam's products, including those made in Brazil where the scrap market is still almost nonexistent, contain 66% (according to the ISO 14021 standard) of metallic scrap.
This consolidated figure integrates the excellent performance of the stainless steel melt at our Stainless Europe sites, which is reaching 86% (according to the same standard) on average in 2022, with some of our Austenitics from Genk recording rates over 91%.

Voice

"Thanks to the acquisition of ELG, we can increase our scrap ratio by producing special blends for grades that have constraints for elements like copper, cobalt, phosphorus, as well as for grades in which the final Nickel content is far above or below the proportion in normal stainless austenitic scrap.

This allows us to align our innovation programs for better scrap sorting at our own mill sites, our customers' sites and at Aperam Recycling sites. The ultimate result will be better scrap quality, especially for high alloyed grades."

Guido Moermans,
Head of Raw Materials Valorisation

Aperam Châtelet "Scrap ratio optimization" team on the site's scrap yard.

> Located on the Isbergues platform, our Recyco subsidiary is an incredibly versatile operation that can transform a multitude of different (dangerous) wastes into intermediates that are being used as Nickel, Molybdenum and Chromium raw materials for our Belgian steel plants. These wastes can have a multitude of origins, like for example the recycling of household batteries, catalysts from production of vegetable oil, or residues of the coating industry. Other more familiar wastes are the dust from our own operations that are being transformed into blocks as well.
As every waste is different and needs a "personalised" way of handling, Recyco operations are quite complex, but also have a great potential to replace more and more of the primary metallic raw materials we use today.

Radioactivity alarms

In spite of their positive environmental contributions, the trading and processing of secondary material also poses a challenge to our Aperam Recycling segment: the detection of radioactively contaminated substances that could enter the recycling cycle, for example through medical or technical equipment that would not have been disposed of properly.

> According to Aperam Recycling "Radiation Guidelines", employees at scrap yards are to be regularly trained on the subject by our internal Radioactivity Detection Officers, so that only products with radiation exposure below the natural ambient levels are delivered to our customers - an essential securing measure for the safety of our employees too.
Our yards are equipped with stationary detection systems for incoming and outgoing material. Additionally, our cranes are equipped with grapple detectors to further enhance the probability of detection of small parts. All these detection systems are inspected and maintained by an external company once a year.

Radioactivity Monitoring (#)	2022	2021	2020	2019
Dedicated Internal Audits (Prevention)	**4**	5	3	1
Internal Alerts - reported by the units	**180**	264	272	303
External Alerts - reported by the customers	**3**	11	16	11

> In 2022, 3 external alerts only were recorded, all in the second semester, a significant improvement versus our historical levels. While the reduction in 2022 alarms was impacted by lower scrap volumes, it is also noted that the 3 external alarms were all a result of very low levels of radiation activity. As a fundamental principle of nuclear physics, it must be accepted that even with up-to-date Radiation Detection Equipment, a 100 % guarantee of detecting any and all radioactive particles in the material cannot be achieved.
At our own yards, no major defects or shutdowns due to radiation alarms were reported.

Other Initiatives

Industrial Risk

Risk prevention programme

> In the previous report, we presented the consolidation of our industrial risk prevention programme based on:

- Mitigating the outstanding risks
- Identification of new potential risks
- Prevention of the risk occurrence
- Strengthening of the risk governance

This year, we would like to highlight some 2022 initiatives about one of the main potential risks in our cold rolling mill process : the acid hazard.

■■■ All along the year, various Aperam plants hosted local firefighting teams for training and exercises on specific risks, particularly the chemical risks.
At Gueugnon; in October 2022, 12 local firefighters from all the Saône-et-Loire department came for a special exercise around the hydrofluoric acid storage issue. These exercises aimed to work on the usage and the set up of specific equipment and procedures. The Aperam fire brigade members and part of the Aperam workers participated in order to share their knowledge about this risk.
At Isbergues, the exercise took place on March 24, 2022. Combining the internal firefighters and the local firefighters, the chain was quickly put in place to manage a hydrofluoric acid fluid generating risky vapours in the direction of the South, with the risk to affect the local Research Center and other entities present on the platform. Immediately, all external authorities were alerted and a press briefing was organised. The responsiveness of the entire rescue and decision-making chain of the Isbergues platform made it possible to manage the event in the best safety and security conditions.

> In 2022, we can notice several concrete achievements in terms of risk prevention and among them, let's highlight the following:

- Isbergues: the implementation of a new acids transport pipelines on our LC2i line
- Gueugnon: the building of new acid pipe for chlorhydric acid was taken into account as part of the last prevention and risk control devices (double skins and leakage detection system)
- Imphy: a dedicated risk assessment (based on HAZard and OPerability analysis methodology, HAZOP) on the pickling line led to a solid list of preventive actions about leakage prevention, mixing risk prevention…

Above: Teams in action at Gueugnon.

Below, left and right: Exercise at Isbergues.

Remediation and decommissioning

During 2022, we continued to clean our former Firminy site and found an agreement with local administrations to have them finalise the remediation with additional Aperam fundings, so that the site can host new industrial activity in the coming years.
About the remediation of the L'Ardoise site, closed in 2005, we are strictly monitoring the residual pollutions and, as part of that, our water discharge monitoring ensures that there is no deviation related to the leaching of pollutants into the rainwater.

Climate-Change Risk assessment

> In 2022, we continued with our approach to integrate the physical Climate-related risks into our Industrial Risk framework.
Indeed, based on a first TCFD-inspired pilot exercise launched in 2022 on a few sites, we have gained in maturity to launch a global screening covering all our industrial locations (more than 90 sites) and the 20 locations of the main suppliers in terms of critical goods or raw materials.
This screening done for a complete list of chronic and extreme hazards (in line with the EU Taxonomy) relies on two scenarii suggested by the IPCC (SSP2-4.5 and SSP5-8.5). Based on these results, a drill-down is realised on the most important climatic hazards taking into account some 80 processes for Aperam. Following the ISO 14090:2019 and ISO 14091:2021 standards (both related to climate change and risk assessment) and the TCFD requirements, our dedicated multi-year project is divided into several steps.
At the end of the exercise, the two timescales 2030 and 2050 will have been analysed for risks as much as for the adaptation plans, and for the whole group.

> In parallel, a specific working group with senior members of the organisation is working on the governance and the transitional risks, in line with the TCFD recommendations, with a clear mandate from Aperam's LT. At Board level, topics related to Climate Change are being covered by the Audit & Risk Committee.

Transportation Impact

Freight Transportation

> In 2022, we began to implement the ESG criteria in the selection of carriers as well as all other suppliers. For road carriers, this includes the training of all drivers to eco-driving, the investment of trucks in alternative fuels (LNG, Bio-fuels, Hydrogen, Electrical) and for the biggest ones the ISO 14,001 certification.
We aim to reduce air shipments to the most and Aperam Stainless Europe shipped less than 100 tons by plane in 2022. In comparison, in 2017, Aperam Stainless Europe shipped more than 1,000 tons of stainless coils by plane, mostly to the United States and China. In the Alloys division, the air shipments remained stable at 487 tons in 2022 vs. 527 in 2021.
> The considerable increase in energy costs, which started with the war in Ukraine, the limitations imposed by rail ports and the closure of some of them especially in Eastern Europe, conjugated with the production drop in the second half of the year penalised the efforts undertaken in 2021 to shift shipments of finished products from road to multimodal or rail mode. In 2022, we shipped only 20 085 tons in 325 wagons from Isbergues vs. 30 909 tons in 487 wagons in 2021. From Genk, the shipments by multimodal transports represented 129 kt in 2022 vs. 173 kt in 2021. In Gueugnon, multimodal transports are limited to the UK and represent only 1215 tons in 2022.

We will pursue our efforts in 2023 to increase our rail transport share, as the gap between rail and road transport prices reduces and as new rail motorways and rail ports open or increase their capacities.

Transportation Impact (estimates[1], excluding maritime)

(Excl Aperam Recycling)		2022		2021		2020	
Indicator	Unit	Brazil	Europe	Brazil	Europe	Brazil	Europe
Rail traffic	% shipments (except Maritime)	**5,4**	**42,8**	11,6	**44.4**	**16.2**	**45,2**
Road traffic		**94,6**	**46.9**	88,4	**45.3**	**83.8**	**51,4**
River/Other traffic		**0**	**6.7**	0.0	**6.6**	0.0	**0,4**
Short sea		**0**	**3.6**	0.0	**3.6**	0.0	**3,0**
Trucks loading	%	**90,8**	**84,8**	**92,1**	**81.7**	**92,8**	**82.3**

(1) Estimation based on major plants, all European Service Centres and most of the Alloys division's transports.

Aperam Genk internal parking area, covered with solar panels in 2022 and equipped with electrical car chargers, as part of the project building Belgium's biggest solar farm (p.35)

Biodiversity

In response to growing concerns of our stakeholders, as well as in view of the strong consensus appearing on the intertwined issues of Climate Change and Biodiversity, we decided to set up solid and systematic biodiversity plans at our main plants. We built a company-wide procedure that defines the basis for a minimum, systematic biodiversity monitoring, even in areas where the issue is not considered as manifest. Based on the Global Reporting Initiative and ResponsibleSteel™ frameworks, this approach entails a preliminary identification of local, vulnerable or invasive species, their natural habitats, and of the possible disturbances that changes in our operations (artificialisation, lightning at night, etc.) could cause. The goal is to combine this baseline with a proactive plan to be set up in cooperation with local experts such as regional or municipal authorities or NGOs.
In 2022, we added in our monthly dashboard new indicators on Biodiversity to track the progress of the site's implementation of our global program ensuring a continuous improvement.

Aperam BioEnergia nursery in Minas Gerais (Brazil)

BioEnergia Harvesting in progress.

River in the native parts of the forestry.

Maintaining biodiversity in a monoculture in our BioEnergia forestry

As mentioned before, Aperam generates its own charcoal from BioEnergia's forests to fuel Brazilian blast furnaces and produce pig iron, eliminating the use of polluting, extractive coke.
This subsidiary is the only Aperam unit with a strong historical Fauna Monitoring Programme in place to scrupulously monitor local diversity in the Jequitinhonha Valley of Minas Gerais (Brazil) and the sole entity operating in protected areas or areas of high biodiversity value GRI 304-1.

However, as BioEnergia's forestry is a monoculture, we need to address the general public's concerns on its potential negative impacts.

1- BioEnergia's forestry has been planted for decades and is **in no way contributing to deforestation**, which is a valid concern from environmental organisations. All the land used to be a large, mostly infertile, and little-used territory that the Brazilian government decided to dedicate to profitable activity back in the 1970s.

2- Our trees are almost sterile and cannot multiply outside of cultivated parcels and disturb the local ecosystem and flora. Thus, they cannot be considered an invasive species. In addition, Aperam BioEnergia maintains vast native forest areas (almost a third of our surface, well beyond the 20% required by Brazilian law) as **a reserve of local biodiversity**, protects them from possible fires and diseases, monitors their development level, and occasionally replants the land with local species.

3- Aperam's forestry management systematically avoids the use of chemical fertilisers and pesticides that concentrate into the soil and water and follows the best practices.
Our forestry is increasing the volume of CO_2e stored on a yearly basis, making it a "**carbon sink**". After harvest, the leaves and twigs are allowed to degrade naturally into humus, aerating and enriching the soil with nutrients, keeping humidity, and stimulating underground biodiversity - see also page 32-33.

4- Eucalyptus requires water and nutrients to grow and survive, but the biological efficiency of the wood is higher compared to other agricultural cultivations. Studies demonstrate that eucalyptus consumes the same amount of water as native forests. BioEnergia's genetic improvement technology has adapted the trees to the dry local conditions, depriving the plants of pivoting roots that can reach water tables, contributing to the **preservation of soil extracts and water resources**.

5- We take our responsibility seriously and **work closely with external experts to continually improve our practices**.
We established partnerships with several organisations dedicated to forest management in Brazil. These partnerships allow BioEnergia to benchmark its practices and ensure that it adheres to the highest standards. Additionally, the forests are FSC®-certified, and BioEnergia is also certified under ISO 14001.
We won several awards for our innovative forest management practices, including the III Best Environmental Practices Award of the State of Minas Gerais in 2019 and the Brazil Ministry's SEMAD Recommend Seal in 2021 for our programs promoting an ecologically balanced environment.

Looking forward to 2023 and beyond, BioEnergia remains committed to upholding the highest standards in sustainable forest management and continuing to work alongside our valued partners to improve and innovate our practices.

Raising Awareness

Our Oikós Environmental Education Centre in Brazil

Located in Timóteo, the Oikós Environmental Education Center is a 989 hectare piece of Atlantic forest, which houses numerous springs and species of fauna and flora. It hosts several activities, including visits for scholars. Training courses are also offered to the community, with a focus on the recovery of springs and degraded areas, through a partnership between the Foundation and the National Rural Learning Service - Senar. With a list of courses aimed at professional training and social promotion, this initiative also offers classes for Multipurpose Forest Workers on topics such as the recovery of degraded and altered areas.
More than 60,000 visitors from different age groups have passed through Oikós to raise awareness of this rare biodiversity riches - and it also acts as a carbon sink, as evidenced by our calculations!

Introducing mascots as a way to raise awareness on biodiversity

In October 2022, we held our first Sustainable Development Week to reinforce Aperam's ambition to combat climate change and address biodiversity.
Biodiversity loss is a pressing environmental issue with an estimated one million species at risk of extinction. Aperam encourages all its employees to take action and protect biodiversity by promoting sustainable practices, conserving natural habitats, and reducing its carbon footprint. Through Sustainable Development Weeks and ongoing efforts, we aimed to inspire everyone to prioritise biodiversity in their sustainability efforts.
> Daily newsletters raised awareness about the biodiversity surrounding eight of Aperam's main plants and highlighted specific initiatives, such as implementing beehives (Isbergues, Châtelet, Gueugnon and Pont-de-Roide), resorting to differentiated mowing (Pont-de-Roide) or installing birds nests houses (Genk), all of which are ways to preserve biodiversity.
Employees expressed what biodiversity meant to them through videos.
> Also, fun quizzes were included every day to test our collective knowledge on the mascot chosen by each plant.

The eight main Aperam plants in France, Belgium, and Brazil are tackling biodiversity as a key topic, making the best possible efforts to nurture the environment in general and to protect a particular species or element of biodiversity in their local environment they selected as their mascot to epitomise their commitment. Local actions are planned in partnership with local associations to build stronger plans and continue to raise awareness across the year.
A specific graphical design is also planned for the next release of our Entrance posters.
Preserving Biodiversity is fully integrated in Aperam's CSR program!

The mascots elected by our plants to epitomise their Biodiversity program.

EcoTree & Aperam Saint-Denis

The office site in Saint-Denis, France, has established a partnership with EcoTree. EcoTree is a nature-based B-corp organisation with forests across Europe, that allows you to commit to reforestation and biodiversity.

> In 2020, Aperam Saint-Denis' Social Committee already signed with this labelled organisation on three biodiversity operations, among which the sustainable management of 70 chestnut trees in the forest of Pont de Buis.
> In 2022, in order to raise awareness and involve the Saint-Denis employees in this campaign, they were asked to choose the next project Aperam will be committing to for the coming 2 years. They chose to contribute to the restoration of a 5,000m² wetland in France. Wetlands are key ecosystems of which 80% have disappeared in France since the beginning of the 20th century (and over 50% in Europe). They form a special ecosystem that is home to 40% of the world's animals and plants and also help prevent soil erosion and flooding.

"*During this initiative, the employees of Saint-Denis showed great maturity by expressing a less traditional investment choice by preferring the rehabilitation of a wetland to the reforestation of a burnt forest area. The partnership is for two years and will be closely monitored.*" says Bruno Pellerin, treasurer of the CSE Saint-Denis.

Collaborative efforts on the ‘Ecolonomy’ project

In 2021, the Isbergues site of Aperam has embarked on an innovative "Ecolonomy" project aimed at transforming the industrial platform and meeting future environmental challenges while improving the quality of life for employees. The project has received widespread support from employees, local management, and stakeholders, with several companies located at the site already joining the initiative. The “AGIR” group (which means “act” in French), made up of Aperam employees, was created in 2022 to advance the Ecolonomy project, with more than 20 members involved. The project seeks to involve local partnerships.

■■■ An example of an action carried out in partnership with other organisations is the revegetation project at Recyco with the support of an external consultancy, and the association Canopé Reforestation.
As a result of the 2022 preparation plan, 700 trees were planted in January 2023 with the combined aim to create a natural barrier to limit dust emissions outside the plant and of course to promote biodiversity as part of the ‘Ecolonomy project’. The planted trees are of several local species adapted to the soil and weather conditions of Isbergues.

> Other initiatives under the same ‘Ecolonomy’ project include conducting ‘Climate Fresk’ awareness workshops (a serious collaborative game to learn about Climate change, its mechanics and consequences) with the site-level executive committee members of Imphy and Isbergues, and renovating the Isbergues Research Center.
To coordinate the projects, an internal project manager was assigned and 2 hours per week were granted to the members of the AGIR team for them to actively work on the project.
> Plans for 2023 are to continue greening the site and to study the mobility of the platform.

Tree planting by Aperam employees in Isbergues

Voice

“The transformation of our industry must be holistic and take into account the 9 planetary limits identified by the global scientific community, climate change being of course one of them. Biodiversity integrity, land-system change or biogeochemical flows (N,P) are other important limits, some of which have already been crossed.

Fully aware of these limits imposed by the laws of physics, without denigrating our needs and technical constraints, I’m firmly convinced that Aperam is moving in the right direction by integrating these limits in our future developments, at different scales, from the production site level (Ecolonomy project) up to the development of an innovative bio-based Ni production chain (Botanickel).

As the Executive Manager of Botanickel, I’m strongly committed to developing the business in line with these impositions because I am convinced that it is the best way to ensure a sustainable and profitable activity for Aperam in the long-term.The Botanickel’s commitments clearly reflect this desire for inclusive development.”

Aurélien Buteri

Executive Manager of Botanickel,
Environment. Project manager in the Aperam CTO Sustainable team.

Botanickel
By Aperam & Econick

Using plants to extract nickel from soil and then turning that nickel into stainless steel may sound like science fiction, but that's exactly what Botanickel is doing.

Aperam, a leading global producer of stainless steel, together with Econick, a spin-off of France's University of Lorraine that specialises in the phytoextraction sciences, have formed a new joint venture. Called Botanickel, the company seeks to become a world leader in the responsible and sustainable production of biosourced nickel for the stainless steel industry.
To accomplish this goal, the company is leveraging the incredible power of hyperaccumulator plants.

Botanical Power in Action

Hyperaccumulator plants are unique in that they can grow in specific metalliferous soils that are often inhospitable for cultivating traditional crops. These plants have developed the ability to safely accumulate extraordinarily high amounts of heavy metals in their aerial parts, including cobalt, cadmium, manganese, zinc, and of course nickel.

Taking Sustainable Stainless steel to a Whole New Level

With nickel being a key raw material in the production of stainless steel, Botanickel will leverage the plant's hyperaccumulator capabilities, to extract the metal from the soil. The native plants will be cropped in soils that are naturally rich in nickel and allowed to grow to full maturity. Once harvested, the plants are dried and their energy is recovered and used by local communities. Nickel is then concentrated and transferred to Recyco, Aperam's European recycling unit initially dedicated to recovering and treating the metallic content from melting shop dusts. Botanickel's process also generates by-products that can be used as high value fertilizers, exemplifying its commitment to the circular economy.

"We aim to set the global standard in the sustainable production of biosourced nickel, with a value chain spanning from the plants in the ground to the stainless steel used in a plethora of products and solutions. More so, we want to do this with respect for the climate, the environment, and the local communities we operate in".

Tim di Maulo, CEO Aperam

"Over the years and by working with leading experts from around the world, Econick has accumulated a high level of expertise in the cultivation and treatment of nickel-hyperaccumulator plants. The benefit of our close collaboration with Aperam is it ensures we will significantly contribute to the switch towards a new, eco-designed mode of producing metals at large scale and in the long-term".

Claire Hazotte, PhD in Chemistry, Manager – Econick

Our Commitments

Respecting the environment, reducing carbon emissions, supporting the circular economy, and empowering local communities – Botanickel takes sustainable stainless to a whole new level.

Reference

A pioneer in using plants to extract nickel, Botanickel aims to become a reference in the production of biosourced nickel and, in doing so, bring an unprecedented level of circularity and sustainability to the production of stainless steel.

Co-development

Involving local communities across the entire value chain is at the heart of Botanickel's strategy. We will develop opportunities in research, education, training, employment and energy production that are aligned with local priorities.

Biodiversity

Native hyperaccumulator plants, cultivated in accordance with the principles of agroecology, will improve soils that are naturally inhospitable to common crops while also preserving the local environment and protecting biodiversity.

Climate

Driven by an urgent need to reduce global greenhouse gas (GHG) emissions, Botanickel will have the potential to massively reduce the CO_2 emissions associated with the production of ferronickel and thus Aperam's stainless steels (Scope 3).

Interacting with our Stakeholders

We aim to achieve best practices in governance and apply the strongest business ethics. These are the keys to building trust with our customers, our employees and the communities we work in, to protecting our market position and licence to operate, and ensuring our ability to thrive.
Our strong customer focus, with innovation and R&D being key pillars, is a testament to the fact that we are good at listening and able to find the right solutions - a pattern we repeat in our social dialogues and stakeholder engagement.

Sustainably Profitable

2022 Financial Performance

> While the first half of 2022 saw a continuation of 2021's 'post-pandemic' economic revival, this was cut short by Russia's sudden invasion of Ukraine. The war has had far-reaching impacts, causing energy and raw material costs to skyrocket and disrupting supply chains. Despite these adverse circumstances and the significant cost increases our business faced, Aperam successfully maintained its production levels and continued to serve its customers consistently and without interruption.

> As a result, 2022 was a particularly asymmetrical year, with Aperam's having its most profitable half-year since its creation, with an EBITDA of €712 million in H1 while only recording for the second half €364 million, the result of destocking and record imports from Asia.
Thanks to a combination of cost reductions, growth and mix improvements under Phase 4 of our Leadership Journey®, we are adapting our footprint to defend our cost leadership in Europe : this is done by targeting volumes and expertise at the most efficient lines and almost doubling Capex (reaching €296 million in 2022 compared to €152 million in 2021).
> In 2022, we strengthened our circular economy strategy with the creation of Aperam Recycling & Renewables. Our fourth operating segment is based on the newly acquired ELG Recycling business and includes the Recyco and BioEnergia sub-segments. Per our ESG roadmap and general strategy, this allows us to complete our production chain, starting with the collection of scrap and production of sustainable charcoal as our own sustainable raw material sources. Subsequent links in the value chain are represented by other steel processing segments.

ESG monitoring as part of all our processes

Because we truly believe in sustainability, we do not define success using financial criteria only but by using a number of lagging and leading key performance indicators that ensure we are responsibly moving in the right direction in many dimensions.

> On the Human Resources side, Health & Safety has long been our first individual performance target and an important aspect in our people's annual evaluations. In addition to our other ESG indicators, which are allocated individually, our Performance Share Unit Plan (PSU) includes the following indicators, altogether for a total weight of 20% : reduction in Total Recordable Incident Rate (TRIR) reduction; percentage of women amongst the Top-1000 employees (both for 5% each); and the completion of our CO_2e emissions' reduction targets for the remaining 10% - see more details p. 89 of 2022 Annual Report.

> On the financial side, we have been using an internal CO_2 price since 2016, along with a qualitative assessment of all investment projects on 5 dimensions of Sustainability (Health & Safety, Customer impact, Social impact, GHG, and a last environmental dimension depending on the project). By crediting low-carbon investments with a bonus and penalising others, it encourages project holders to rework initial designs to mitigate negative impacts.
New in 2022, Aperam entered into a Revolving Credit Financing and a Term Loan (see p. 38, Annual Report), both of which are linked to two strategic sustainability commitments : first, to become a best-in-class stainless steel manufacturer in terms of Health & Safety by consistently exceeding the ISSF industrial average in terms of TRIR (standing at 7.01 in 2022, see p. 15) and, second, to maintain Aperam's leadership in low carbon steel making and de-fossilisation (reflected by a decrease in CO_2e intensity).
While not reaching our goals will result in more expensive financing, achieving them will mean a discount in the interest rate we agreed to allocate to financing more sustainability actions.

2022 Open Day at Aperam Châtelet.

At a glance GRI 2, 204-1, GRI 413-1

Indicator	Unit	2022	2021	2020	2019
Customer Satisfaction: Alloys	Rate on 10	n/a	9.15	n/a	8.8
Customer Satisfaction: Stainless		7.0 - 7.8(2)	7.9 (1)	8,0(1)	n/a
Innovation (R&D spent)	€m	21	18	16	20
Lobbying Expenses - Europe		0.57	0.64	0.87	0.20
Lobbying Expenses - Brazil		0.32	0.45	0.12	0.22
New products in sales - Stainless(3)	Index base 2019 or 2020	76	69	58	100
New products in sales - Electrical Steels(4)		247	261	92	100
New products in sales - Special Carbon		154	69	131	100
New products in sales - Alloys		554	168	100	n/a
Fraud Allegations Reported	#	**22**	**13**	**12**	**12**
- Forensic Cases Founded		2	4	4	1
-- Significant Cases(5)		0	0	0	0
Ethical Allegations Reported(6)		**54**	**10**	**4**	**0**
- Ethical Cases Founded		15	2	4	0
-- Significant Cases(5)		0	0	0	0
Local Purchase at Main Sites(7)	%	**41**	**45**	**51**	**50**
Stakeholder Engagement at Main Sites	%	**100**	**100**	**100**	**100**

(1): Europe, (2): Specific European countries.,
(3): European and Brazilian production together. (4): Electrical Steels Grain Oriented and Non Grain Oriented produced in Brazil.
(5): Following review by the Audit & Risk Management Committee.
(6): Human Rights including Health & Safety, Environment, Data privacy and other topics that can be reported through the whistleblowing hotline after scope extension in 2019-2020.
(7): Includes centrally sourced energy.

> Another major achievement of 2022 was the (on-site) external audit of our Timoteo plant under the ResponsibleSteel™ scheme.
This confirmed our intent to address the full spectrum of business responsibility and challenge our existing practices, ultimately leading to our certification in early 2023.

Long-term Strategy

Efficiency as an Employer's Responsibility

> With our European downstream operations tailored to market conditions, we are able to capture opportunities for a sustainable future. This adaptation involved reducing our tools from 29 to 17, but also, when necessary, responsible headcount reductions (see previous reports and above). According to analysts, Aperam achieved an impressive turnaround in its first decade and is ready to seize the opportunities arising from the long-term growth perspectives of our markets. This responsible strategy and its efficient delivery explain the regular awards we receive from financial and ESG analysts (see previous page).
In 2021, with the acquisition of ELG (see p. 10), we open a new chapter of Aperam's history.

> Overall, in 2022, we channeled €675 million in salaries and €130 million in taxes to local economies, compared to a respective €535 and €136 million last year (GRI 201-1).
We also play an important role through our expenses. In particular, in the locations where our largest sites are placed, in Belgium, France and Brazil, the local economy development is also part of our strategy. In 2022, our non-energy local spend portion increased to 55% (compared to 51% in 2021), however, our overall local spend incl. energy (sourced centrally) decreased due to the high contribution of Energy prices developments (GRI 204-1).

Relocation of Tubes manufacturing operations from Uruguay to Brazil

The technological development of manufacturing systems, the increase in freight rates, the lack of proximity of customers and raw materials with respect to other locations, as well as the increase in the labour cost compared to other countries in the region, had severely damaged the competitiveness of our South American Tubes business located in Uruguay (Montevideo). As a result, we have decided to concentrate its business units in fewer locations to gain efficiency, moving our operations from Uruguay (Montevideo) to Brazil (Viracopos) where most of our automotive customers are located, also investing in the most modern lines in the tube business.

Unfortunately it led to the loss of 180 jobs in Montevideo, while new jobs were created in Brazil (total net result for our South American Tubes business amounted to -109 jobs, the same in FTE). Aperam acted in line with all our obligations under the local labour law. Our employees in Montevideo also had the opportunity to apply for jobs in Brazil.

Social climate and Social Relations

In 2022, we kept our strong involvement in the social dialogue with all the stakeholders, sharing and explaining the complexity of our context, especially in Europe where we faced a strong modification of our economical and business situation during the second part of the year.

> We had constructive and numerous exchanges with the trade unions and the local working councils in order to find the best way to responsibly adapt our organisations to the variation of the level of activity, especially in Isbergues, Genk and Châtelet.
> Our involvement in the social dialogue is embodied in France by the contractualization of our social policy with the trade unions with the implementation of three major new national agreements in 2022 on diversity, the quality of life at work and health insurance. Specific measures were taken to deal with the impact of inflation on lower salaries.

> We continued to share with the employee representative in the EWC (European Works Council), the implementation of our key European projects as the review of our "European Footprint" or the ramp up of the BUL4 in Genk, and the impacts of the energy crisis and the Ukraine war on our industry.
In 2022, we held our 4 regular meetings with our EWC (select committee meetings and plenary sessions), and had an additional extraordinary meeting in august for the restricted committee to exchange with the senior management on the specificity of our business context considering the surge in energy prices and the evolution of demand.

Voice

"2022 was a year with two very different periods in Europe, with a radical change of context that led to in-depth exchanges at local and European level to share Aperam's situation and actions.

In a constructive social dialogue, we have sought the appropriate balance to maintain our medium and long-term actions by investing in skills and our footprint to prepare for the future and manage the necessary short-term adaptations with temporary actions. "

Florian de Gélis
Head of Human Resources France,
Employee Relations in the European Work Council

> As usual we “variabilized” our labour costs in Europe in line with decreasing production volumes in the second half of 2022. As a result, the 2022 temporary unemployment rate was less than 7% of the 2020 levels in 2022 in France (mainly in Isbergues, which corresponds to less than 1% of the annual country workforce) but still 30% in Belgium (corresponding to 3.4% of the annual workforce) - and zero in Brazil (see table below).

Employee Survey

75% believe strongly in the goals and objectives of Aperam

> The climate survey 2022 demonstrates the proximity and the quality of the social climate within Aperam, with 79% of our employees recommending Aperam as a good place to work and 82% considering that their immediate leader is accessible and available when they want to talk or need help.
See also in the table below the favorability to the questions from the “sustainable engagement”.

Social Climate

Indicator	Unit	Group 2022	Group 2021	Group 2020	Belgium 2022	Belgium 2021	Belgium 2020	France 2022	France 2021	France 2020	Brazil 2022	Brazil 2021	Brazil 2020
Temporary Unemployment[1]	FTE	n/a	n/a	n/a	69	35	227	15	32	221	0	6	77
Employee Sustainable Engagement[2]	%	78	83	n/a	74	72	nc	71	70	nc	85	88	nc
Absenteeism	%	3.2	2.7	3.4	5.5	5.2	4.8	4.2	3.4	5.1	1.5	1.6	1.5

(1) number of hours divided by local annual legal reference (in hours)
(2) % of "favorability" for pilar sustainable engagement

The Impact of ResponsibleSteel™

“Aperam already used to orient its management in line with the 3 pillars of sustainability, however the ResponsibleSteel™ framework offered us some learnings and reflections that enabled us to improve our processes and activities, like the way we manage our environment but also our greatest asset, our people!”

Many Maria Moreira
Aperam South America, Improvement Program Analyst

Our Employers’ Impact GRI 2, 201-1, 204-1, GRI 413-1I

Aspect	Local Contribution	Unit	Belgium	Brazil	France	WorldWide
Scope	Plants/Division	sites	Châtelet, Genk from Stainless Europe	Timóteo, Stainless & Electrical Steel South America ; BioEnergia of Recycling & Renewables	Imphy, Amilly, Rescal from Alloys ; Gueugnon, Isbergues, Pont-de-Roide from Stainless Europe ; Recyco	Imhua (PRC), ICS (IN) from Alloys & Specialties Usti (CZ), Rodange (LU) from S&S Tubes
	Service Centres		Genk (BeNeLux).	Campinas, Ribeirão Pires, Viracopos, Caxias do Sul .	Isbergues, Lésignan.	Germany, Italy, Poland, Iberica, USA, Argentina.
	Scrap yards		Zutendaal	/	Saint Romain, Limay, Colomiers	USA, Germany, UK, Spain,... [4]
	Main Offices		(Genk)	Belo Horizonte and São Paulo	Saint-Denis	Luxembourg HQ and Sales Offices[1]
People	**Own Staff (End of Period)**	FTE	2,030	3,816	2,492	2,398
	o/w Blue Collars		*1,309*	*2,847*	*1,422*	1,356
Local Economic Contribution	Forex rate (BRL)	€	n/a	5.4	n/a	n/a
	Wages & Benefits	EUR million	191.6	101.1	213.4	168.9
	Community Investments		0.04	0.51	0.06	0.09
	Payments to Government		14.6	62.9	21.6	30.9
	Economic Value Distributed		3,676.2	1,435.4	2,802.9	346.5
	CAPEX		95.8	110.5	65.0	24.6
	Total Tax Contribution[2]		72.1	96.6	108.8	n/a
	Local spent of main sites[3]	%	37.6%	27.3%	57.5%	n/a

(1) Canada, China, Czech Republic, Dubai, India, Japan, Korea, Mexico, Nordic, Russia, Switzerland, Thailand and the United Kingdom.
(2): Sum of all the amounts levied with respect to Corporate tax, other taxes (taxes on assets, environmental tax,etc.), including social contributions (employer and employee share), the latter being also included within Employee Wages & Benefits (GRI-201-1)"
(3): % of Local spent of main sites (Châtelet, Genk, Timoteo, Imphy, Gueugnon, Isbergues, Pont-de-Roide) excluding Raw Materials, with local spent defined as paid to suppliers respectively from Belgium, in Vale do Aço (Minas Gerais), and France. (GRI-204-1)
(4) and entities with less than 50 persons in: the Netherlands, Taiwan, China, Japan, South Africa, Canada, Russia, Australia, Italy, Singapore, Czech republic, India, ordered as per quantity of employees.

Responsibility in the Value Chain

Overall Supply Chain CSR Risk Assessment Methodology

In 2022, Aperam went further on the deployment of the latest version of its Responsible Purchasing Policy (2020). This policy is to be read in conjunction with our Code of Business Conduct, which suppliers are also informed about, and our general purchasing conditions that highlight our principles and our expectations towards our suppliers. These documents will be henceforth referred to collectively as 'our policy'.

Our policy requires suppliers to participate in regular assessments and to diligently inform us in the event of significant incidents, for instance one impacting local communities or the environment. Our policy also clearly establishes that working with supply chains that do not comply with our high ethical standards is not aligned with our practices. For instance, we remain attentive to our purchases involving the PRC province of Xinjiang to avoid benefiting in any way from the forced labour imposed on the Uyghurs. In the end, when our due diligence concludes that a situation deviates from our standards and is not likely to be remediated and improved, and/or our demands in terms of information or monitoring remain insufficiently addressed, the business relationship will be either suspended or terminated.

In 2021, we informed all our raw and non-raw material suppliers about this new policy. But proper implementation also requires continuous training. As of the end of 2021, 100% of our sourcing buyers completed training modules 'Conflict Minerals' and 'Protecting Human Rights'. Starting in 2022, the Responsible Purchasing training, which includes elements pertaining to the ResponsibleSteel™ standards, is obligatory to all buyers and is requested once a year. As of today, 95% of the non-raw material and 100% of raw material buyers have been trained.

Risks Amongst Raw Material Suppliers

> In 2022, we assessed 97 suppliers and continued our analysis concerning CO_2 emissions. We have simplified the questionnaire in order to better understand our suppliers and raise awareness about the importance of the Science-Based Target initiative (SBTi). Although doing so postponed our analysis, it allowed us to have a more precise and mature conclusion.
Only one risk was identified this year. It was related to the fact that a new potential supplier with whom we started testing material declined to answer our ESG questionnaire or to supply information about potential labour rights risk. No active business was developed with them.

Risk Amongst Freight Suppliers

> Last year we continued to adhere to such new international transport regulations as the Transport European Package, which came into force in February 2022. We terminated the contract with one carrier for violation of safety rules during product loading and securing, and we decided to migrate the business we did with two other carriers following justice actions being filed in their countries for violations of local laws related to employment. Other investigations with suppliers considered at risk from the ESG perspective were resolved (see also freight transport impact, page 44).

- One company had to be sensitised to Health & Safety and was requested to systematically apply all safety rules after flagrant ignorance was observed
- A second company was challenged for Human Rights issues after being suspected by the justice authorities of its home country. The case has been sorted, and the supplier was finally confirmed after presenting a complete and detailed action plan
- The other three suppliers were requested to submit action plans.

Their performance is supervised with deep scrutiny and subject to requests for continuous improvement as part of our process

Risks within Non-Raw Materials

> Following the implementation of our 360º supplier assessment process in 2020-2021, during which all critical suppliers were assessed in two waves in one single year (2021) in order to proof test the evaluation method. A new cycle was launched in 2022, to reassess suppliers that had been assessed relatively to their 2020 performance, along with any new suppliers that joined the list. The objective was to confirm the high level performance of those suppliers who earned a Grade A in their previous assessment and to ensure those with lower grades improved their performance levels (considering that 100% of the action plans generated in the previous assessments have since been implemented).

> Overall, 11% of the suppliers improved their scores in comparison to 2020, raising their SPI (Supplier Performance Index), while three suppliers saw their scores deteriorate. For these cases, a deep analysis is ongoing to understand the reasons, identify and mitigate risks, and define actions to raise their scores again. The same analysis and action plan are being applied to the 19% of suppliers who obtained a B score.

This year, 15% of the suppliers did not complete the full evaluation process prior to this disclosure. However, we continue to work to obtain 100% responses and to fully analyse the results and map the risks on this scope.

Supply Chain Risk Assessment

Supply Chain follow-up	Year	Universe covered (#)	Not assessed	Scope analysed (#)	Risks identified in terms of:			Suppliers presenting risks		
					Health & Safety	Other Human Rights & Ethics	Environ-ment	Total #	o/w recurring (>2 ans)	o/w New
Raw Mats	2018(1)	95	13	**82**	2	2	4	**8**	n/a	n/a
	2019	96	19	**77**	2	3	2	**7**	n/a	n/a
	2020(1)	86	21	**65**	2	2	2	**6**	0	0
	2021	106	44	**62**	1	1	1	**1**	0	1
	2022	**97**	**25**	**72**	**1**	**1**	**1**	**1**	**1**	**0**
Non-Raw Mats (main sites' suppliers + transport)	2018(1)	116	0	**116**	9	5	8	**22**	n/a	n/a
	2019	194	0	**194**	13	9	7	**29**	n/a	n/a
	2020	242	0	**242**	6	21	10	**37**	0	2
	2021	239	0	**239**	7	12	8	**27**	1	0
	2022	**114**	**17**	**97**	**5**	**4**	**4**	**13**	**0**	**0**
Total	2018(1)	**211**	13	**198**	11	6	12	**29**	n/a	n/a
	2019	**290**	19	**271**	15	13	9	**37**	n/a	n/a
	2020(1)	**328**	21	**307**	8	23	12	**43**	0	2
	2021	**345**	44	**301**	8	13	9	**28**	1	1
	2022	**211**	**42**	**169**	**6**	**5**	**5**	**14**	**1**	**0**

> Furthermore, in 2022, an improvement to the questionnaire was implemented in order to understand whether our suppliers evaluate themselves through a professional ESG rating agency. 45% answered positively.
This indicator is important and will be followed from now on, as Aperam also confirms its ESG engagement via some rating agencies score and encourages its suppliers to continuously improve on their ESG topics. Another example is the incentive we make in terms of equality and diversity, which has contributed to 60% of our suppliers declaring having implemented gender diversity policies and programs.

The Impact of ResponsibleSteel™

"The Sustainability or ESG concept is a fundamental pillar to ensuring that the steel produced by Aperam is 100% sustainable and responsible.
Our role is to involve and motivate our suppliers to be aligned with our commitments".

Márcio Siqueira da Silva
Raw Material Manager - Brazil

(1) *Update and follow-up of previous year's assessment for Sourcing.*

■■■ Even when dealing with global and reputational firms in our own and well-regulated countries of operations Aperam remains attentive to media coverage and suspicions of pollution or human rights issues.
> As reported in the previous report, in 2021, a risk was identified in Belgium, while we were actively testing new by-product suppliers. After the identification of a media coverage highlighting a suspicion of contamination, a due diligence was carried out. As they did not fully discard the risk and the suspected occurrence, Aperam's decision was to put the trial on hold. In 2022, the Flemish region temporarily suspended the operations of the supplier's unit until they implemented actions aligned with the regulations and paid the fines. Once done, the unit reopened and the supplier provided legal documentation proving the respect of the rules about polluting substances.

> In 2022, Aperam identified two issues with raw material suppliers. As a consequence, we stopped our relations with one extractive company operating in Guatemala, which was reported having environmental litigations as well as issues with the local population.
We also put a contract under suspension with one other supplier in Mexico, considering its operations were stopped by the authorities in relation to environmental issues. This contract was only reopened when the company could prove it was aligned with the regulations.

Risks and Compliance

Risk Monitoring

A Strong Process in Place

Our Risk management process is regularly assessed to ensure it is applying the best-in-class practices. With the support of Global Assurance Risk Management function, a top-down (in Q1-Q2) and a bottom-up (Q4) risk assessment is performed with all stakeholders (Business, platforms and Corporate functions) in order to identify, assess, mitigate and monitor all risks with a review of the mitigation action plans for all key risks. The process encompasses all possible areas, from taxes to natural disasters, including Cybersecurity risks and compliance risks with details on fraud, corruption, money-laundering, economic sanctions. Each risk is assessed in terms of likelihood and impact on financial or non financial criteria.

> This mapping is reviewed by the risk owners until the Leadership Team level. All key risks at group level are consolidated into a Global Risk Matrix, which is validated by the Audit and Risk Management Committee and are disclosed in the Aperam Annual Financial Report (GRI 3-3).

> In 2022, we extended our Risk management process to Aperam Recycling units. We also further improved it through a close follow up of the mitigation action plans for the key risks from our Global Risk Matrix. Based on Ad hoc Approval by the CEO, Global Assurance performed an independent monitoring on the follow up of the implementation of the mitigation action plans on Cyber security risk and also reported it on quarterly basis to Aperam LT and its Board's Audit & Risk Management Committee.

Ethics & Compliance GRI 205-2 to 3, 406-1.

Indicator	Unit	2022	2022 Belgium	2022 Brazil	2022 France	2021	2021 Belgium	2021 Brazil	2021 France	2020
Fraud allegations reported		**22**	**2**	**15**	**0**	**13**	**2**	**9**	**0**	12
- Forensic cases founded		**2**	1	1	0	4	1	2	0	4
-- *significant cases*		**0**	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ethical allegations reported(1)		**54**	**0**	**48**	**1**	**10**	**0**	**10**	**0**	**4**
- Ethical cases founded	#	**15**	0	13	0	2	0	2	0	4
-- *significant cases*		**0**	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Other allegations(2) reported(1)		**9**	**0**	**6**	**1**	**2**	**0**	**2**	**0**	**0**
- Other cases founded		**1**	0	0	0	1	0	1	0	0
-- significant cases		**0**	0	0	0	0	0	0	0	0
Training Rate on Ethics		**65**	**66**	**74**	**47**	78	N/A	N/A	N/A	52
o/w White Collars	%	70	81	82	51	78	N/A	N/A	N/A	52
o/w Blue Collars		47	36	65	32	N/A	N/A	N/A	N/A	N/A

(1) *Including through the whistleblowing hotline after scope extension in 2020*
(2) *Environment, Cybersecurity/Data privacy*

Palais de Justice de Strasbourg - France, Garcés.De Seta.Bonet Arquitectes & Serra-Vives-Cartagena ©jm.bannwarth@drone-images-alsace.com, Aperam 304 with Uginox Top

> The fraud allegations reported through our whistleblowing hotline and other reporting mechanisms are related to misconduct such as thefts, corruption & bribery or conflicts of interests and no significant cases were reported in the year.
The 2022 Fraud allegations (like the previous years) concerned potential or real events where Aperam was the victim of fraudulent behaviours. None of them were to the detriment of other companies.

> All non fraud allegations, such as Human Rights (which cover Health & Safety, Harassment or Discrimination) are reported in the table to the left, within "Ethical", while Environment or Cybersecurity/Data Privacy are categorised as "Others". We see most of the cases reported in Brazil and Rest of the World, in particular the newly integrated perimeter of Aperam Recycling (ex-ELG).
The increase of the number of cases reported is mainly due to the extensive communication made about the possible use of the hotline for non fraud related cases such as discrimination or harassment, but also to the extension of the Aperam scope within the ELG integration. We also started to collect and report on the allegations raised by other means than the hotline (eg: email to Compliance or to management). On the other hand the percentage of founded cases remains stable (GRI 2-26).
All cases were shared with the Audit and Risk Management Committee, which reported appropriately to the Board of Directors. Communications to ensure all employees in Aperam can use this channel are being continued.

> In addition to these investigations, our Global Assurance Department performed 46 audits or advisory services in 2022, with strong focus on Recycling Activities. These provide a full review of our small and medium entities, high risk processes or emerging risks. Since 2018, the team has covered some sustainability-related topics such as Health & Safety and environmental issues. In 2022, our internal auditors performed a specific study on Water management and participated in the preparation of the ResponsibleSteel™ certification in Brazil and in the preparation of its Surveillance audit in Europe.

Rolling Out our Compliance Framework

Mission and Organisation

> In 2022, our Compliance Framework further advanced our risk mitigation efforts. Highlights include:

- Roll out of all Aperam policies at all former ELG units, including, for example (but not limited to) our Code of Business conduct, Anti corruption and money laundering policy, Prevention of misconduct and whistleblowing policy, No gift policy, Insider dealing regulations etc…
- Extension of the whistleblowing hotline scope to all new Aperam recycling units
- Start of the project of third party due diligence screening automation with the compliance screening automation of Brazilian suppliers as a first step (European suppliers and customers worldwide will follow)
- In depth screening of all Russian business partners, including UBO verification, in view of the evolution of the sanctions in order to ensure that we do not trade with sanctioned entities and individuals.
- Strong due diligence in place to ensure that no trading took place in 2022 with entities from OFAC- and EU-sanctioned countries, nor with any of the entities targeted by OFAC and EU targeted sectoral sanctions.
- An in-depth Compliance Risk assessment with input from all concerned business leaders. This resulted in detailed risk matrices covering all compliance topics and included an evaluation of country/activity-specific compliance risks.

Technical Expertise, Audit and Continuous Improvement

Regarding continuous improvement, 2022 saw several in-depth projects related to the automatization and improvement of some of the routines embedded in our People Management system.

> First, thanks to the implementation of an automatic refresh function, all our mandatory declarations, such as Aperam Insiders' personal data and the Compliance Certificate, were automatically updated and refreshed. This allows for a more efficient analysis and follow up by the Compliance Team, resulting in:

- 98% completion of the compliance certificate
- 92% achievement on the conflict of interests declaration

> Second, this same automatic refresh feature allowed us to auto update all our Aperam Insiders' personal data, ensuring an "Insider register" that not only complies with Luxembourgish regulations, but is also extremely effective.

Voice

"Any organisation, as well as Aperam, that conducts business outside its own territory, cooperating with international entities, is exposed to the risk of non-compliance with international sanctions requirements.

Especially at the present time, when along with the war in Ukraine, economic sanctions were imposed on Russia and Belarus, we are facing challenges related to limiting exports to these countries and relocating their business activities to other places in the world.

A proper, effective and meticulous procedure aimed at minimising the risk of non-compliance in our business activities with the requirements of international sanctions is a complex process of verifying our current and future contractors.

Detailed sanctions verification consists in collecting information on: the ownership structure, real beneficiaries, negative information available in the public domain and direct checking of companies and their owners as individuals on official published sanction lists.

We are convinced that the above-mentioned activities, despite the fact that they represent a significant amount of work, are necessary to ensure compliance with applicable regulations and to demonstrate a high level of business ethics."

Aneta Sabaturska-Kopek
Chief Finance & HR Officer,
Aperam Stainless Services & Solutions Poland

Alignment & Behaviours

In terms of alignment, we continued with the roll-out of the routines started in 2017, including the annual "compliance certificate" that summarises the year's actions for key leaders and site managers and the declaration of potential conflicts of interests for all exempts.

Aperam's induction training also ensures that joiners are quickly informed of the company's key policies, with refreshing sessions happening on a regular basis.
For instance, the 2022 mandatory compliance training pack included information on:

- Code of Business Conduct
- Promoting Diversity and avoiding discrimination
- Data Protection Regulation
- Protection of company information
- Fraud awareness

> Regarding the training rates, in 2022, the code of conduct training has been rolled out for blue collars within all Aperam units and will be continued in 2023 in order to ensure that all Aperam employees will have followed the Code of conduct training by the end of 2023. At the end of 2022, the training sessions achieved over 78% participation for white collars and 50% for blue collars - GRI 2- 23.

Communications

Regular awareness-raising initiatives are crucial to fully embed compliance into our culture, mindset and processes. Our communication schedule aims to cover all our topics in just a couple of years, focusing on a few topics every year. In 20221, the following company-wide communication initiatives were organised:

> As with the last four years, Aperam once again celebrated International Fraud Awareness Week. The goal of this initiative is to raise awareness about various fraud prevention and compliance topics and ensure a new, shared vigilance happens at all levels of the organisation.
From 21st to the 25th of November, four live sessions were organised with the participation of the Top 100 team members from Aperam recycling, who was the target audience of this year's edition. 79 participants from 18 countries joined the live sessions (70% participation rate).
The live events were complemented by daily group communications including short movies, quiz questions, a fraud case explained inspired by real cases that occurred at Aperam, and links to our Corporate policies that were sent every morning of the week to all Aperam email holders. These films covered such important compliance topics as:

- The rights of the whistleblowers
- The fraud triangle
- Phishing
- Confidentiality
- Insider dealings
- Conflicts of interests and how to deal with confidential and sensitive information.

> The last company-wide initiative, led by the Sustainability team and with the support of the Compliance, Corporate Inclusion & Diversity Working Group, and Human Resources teams, covered a completely different topic related to our Code of Conduct and Human Rights policies: the fight against discrimination in relation to Disability (see p. 21)

> Finally, we continue sending our key policies to our business partners. In 2022, all active suppliers received the yearly notice of our No-Gift policy, which stands as a key element of our Anti-Corruption procedure (GRI 205-2), and earlier in the year, a letter inviting them to support our stand for corporate responsibility, starting with human rights and health & safety.

Compliance at Aperam South America

In light of the risks posed by operating in different regions around the world, Aperam remains conscious of local practices not meeting our company standards. We operate under the principle of respecting the stricter of the two standards between local and our global company standards.
For example, after two years of being impacted by the pandemic, on top of rolling out our corporate action plan, the Brazil team resumed its proximity training on the shopfloor, which really can help all employees from Aperam South America and BioEnergia memorise our rules and guidance. Such face-to-face training sessions (see picture with Lorena below) and awareness-raising events are organised on several topics, including handling sensitive information, and benefit not only our scrapyard and warehouse personnel, but also our subcontractors. During Anti-Fraud Week, eight sessions were organised, half of which were held live. These sessions covered our Anti-Corruption and Anti-Money Laundering policies and procedures. With this action, 54 people from the Engineering, Sourcing and Financial departments and 75 from the Purchasing, Commercial and Foundation received first-hand training using real-life cases.
To complete the training, regular information is sent via various means. For example, we distributed stickers to put on computers (see picture of Erick, below) and displayed banners along our internal alleys. On the same note, a short version of the Code of Conduct was also added to the H&S booklet, which is distributed to our internal and external workers. As it is mandatory to have the booklet in one's uniform pocket during their shift, it really adds proximity to the shop floor workers! One could even say that our ethical guidelines are physically close to their heart!

Erick with a sticker.

Lorena at the end of a training session.

Voice

"Before the acquisition by Aperam, ELG already had a robust Compliance Management System to provide rules and guard rails for all actions and business decisions, sharpen Compliance awareness and effectively prevent, detect, and mitigate all relevant Compliance risks.

During the integration into the Aperam Compliance Program, the now Aperam Recycling segment has fully adopted Aperam's Code of Business Conduct as well as further Compliance Guidelines and hereby further strengthened its practices by optimising the Supplier Due Diligence process and introducing the Conflict of Interest as well as the Compliance Certificate yearly declarations."

Alexander Kehl
Aperam Recycling Head of Legal & Group Compliance Officer

Global Data Privacy and Cybersecurity

Cybersecurity

Cyberattacks and data breaches are two of the fastest growing risks for companies everywhere, and Aperam is no exception.
That's why we implemented a Cybersecurity Strategy based on 4 pillars:

1. Because our first line of defence against cybercrime is our employees, user awareness is the first pillar of the Aperam Cybersecurity Strategy. To train our employees about this threat, we sent 90,000+ phishing simulation emails in local languages.

We also provided multiple short courses with videos and quizzes via our MyLearning Cyber Academy. Having showed positive results in terms of awareness raising, these initiatives will continue in 2023

2. A second pillar focuses on the timely resolution of security vulnerabilities identified by the regular scanning of IT resources within the internal network and by conducting penetration tests on our websites, which are accessible from the internet.

3. Our third pillar sees Aperam raising new defences to further protect its assets and information. This includes introducing the latest technologies, like multifactor authentication and profounded monitoring tools, to detect and alert any unusual behaviour within our IT environment.

4. As backup, Aperam is revamping and testing its disaster recovery plans and business continuity strategies to ensure critical business processes are quickly restored in the event of a cyberattack.

In addition, an enhanced IT security communication channel has been established within Aperam, accompanied by an improved cybersecurity dashboard to support and assist Aperam management as part of their risk matrix assessment related to cybersecurity and data protection.

Global Data Privacy at Aperam

As an international company with global systems and teams located both in and outside of Europe, Aperam not only enforces the European General Data Protection Regulation (GDPR), but also addresses local regulations with international data flows and processings. As such, Aperam's Data Protection team is supported by a trained network of local data protection correspondents at site level.
A Data Protection Committee is also in place to review the Data Protection department's roadmap, ongoing actions and exchanges with the authorities. The Group is submitted to the National authority of Luxembourg, the CNPD, as its Lead Supervisory Authority.

Voice

"In a global context marked by international collaboration and innovation upheld by technology, we are putting an emphasis on the protection of personal data. By creating an effective data protection culture in Aperam, we aim at giving everyone of us the keys to ensure secure and compliant personal data processing, wherever we are located.
This is the core of my mission as the newly appointed Aperam Data Privacy Officer."

Julia Eisenmann
Company Secretary and Data Privacy Officer

Aperam also sees compliance with the GDPR as an opportunity to rethink its day-to-day activities and customer relationships, beyond the protection of all its stakeholders' privacy.

Relationship with Authorities

In principle, Aperam only engages in policy debates with governments and policymakers on topics that are of concern to its business.
In particular, our Code of Conduct stipulates very clearly that Aperam shall never subsidise any public body, civil servant, member of a political party or union. We also respect best practices in anti-corruption and promote a fair and competitive marketplace without the use of undue influence.
Our expenses in the context of public affairs and trade defence are detailed below, and include all relevant costs borne by Aperam, including the share of the fees paid to National steel making associations that relate to public affairs activities as well as Eurofer.

Lobbying expenses

Indicator	Unit	2022	2021	2020	2019	2018
Expenses - Europe	€m	0.57	0.64	0.87	0.20	0.38
Expenses - Brazil		0.32	0.45	0.12	0.22	0.17

European Carbon Markets

In 2022, only our European operations (which represent 50% of our Scope 1 emissions) were subject to CO_2 emission regulations (in the form of allowances or quotas), and there is no sign that a comparable system will be established in Brazil in the near future.
Based on current assumptions and ETS rules, we do not anticipate an overall shortage of free allowances before the late-2020s

Carbon markets and competition

The EU aims to achieve climate-neutrality by 2050, in line with the EU's commitment to global climate action under the Paris Agreement and the European Green Deal. We fully agree and support this EU target. This objective will translate into new regulations and incentives to invest in the transition (see also Taxonomy p. 36), reduce energy consumption and force all industrial players to adapt their processes accordingly.

As part of the European Green Deal, it is expected in particular that the EU will adopt new and ambitious legislations addressing GHG emissions, circularity, waste management, sustainability, energy, and industrial emissions.

Whilst these new legislations will certainly require the steel industry to adapt and make significant investments, they also represent an opportunity to accelerate the transition to a circular, low CO_2 business model of which Aperam wants to be a frontrunner.
It will be important in this context that the European ambition on sustainability and decarbonization goes hand in hand with appropriate measures to promote and defend a global level playing field, in order to ensure that the European industry is not put at a competitive disadvantage versus imports from countries that do not have equivalent goals and ambitions.

Trade Defense Update

For a long time, Aperam has been closely working with steel industry associations and other local trade associations, especially in Europe and South America, to promote the preservation and development of a level playing field for all market participants.
More and more, this work has also been driven by environmental concerns.
This activity has been particularly intense since 2018 and remains so today, due to the prolonged impact of U.S. protectionist measures (Section 232), the need to secure our markets from a growing number of unfair international trade practices (dumping, various forms of government subsidies, circumvention, etc.), and an increasingly difficult economic environment.

> In Europe, these issues have always been addressed within Eurofer, the European trade association, both during the periodic meetings dedicated to the steel industry's trade problems (External Committee) and, more specifically, within the forums dedicated to the subsector (Stainless Steel Working Group).

In 2022, Aperam intervened through Eurofer in the following files:
- European safeguard measures on steel products
- Anti-subsidies investigation (against India and Indonesia) concerning imports of certain cold rolled stainless steel sheets and coils
- An anti-circumvention investigation against imports of stainless steel hot rolled products from Turkey, made from Indonesian stainless steel slabs
- A dispute at the World Trade Organisation (WTO) against Indonesian export restrictions on raw materials used in stainless steel production, which unfairly restricts international producers' access to raw materials for steel production, particularly nickel.

> In Brazil, Aperam and IaBR (Brazilian Association of Steel Producers) are regularly supporting the Brazilian Authorities for Trade Defence to monitor unfair trade practices.
In 2022, Aperam participated in the following sole case:
- Anti-subsidy investigation on Stainless Steel Flat concerning imports of 304 Cold Rolled (Indonesia).

Stakeholder Relationships

Aperam sites are encouraged to regularly engage with local stakeholders, as doing so is consistent with our values and management best practices and also very important to our employees, who are also often our neighbours. As a fact, this is reflected in our Climate Surveys, the most recent of which record 76% of employees that state they are proud of the company's contribution to the community, with higher scores in Brazil.
In 2021, we formalised our approach in a formal External Stakeholders Engagement Policy, and keep on trying to improve, with an internal management tool to be deployed in 2023-24.

> In Brazil, we have a Foundation that is supporting local communities with "social impact investing" with particular attention on such topics as culture, sustainability, employability and local development. Called the Aperam Acesita Foundation, the organisation operates in Timoteo and the Jequitinhonha Valley, where our forestry is located (see page 60).

Pont-de-Roide welcomed a group of schoolgirls from the Albert-Jacquard College in Lure.

Genk's Junior Day, including a welding test, a fire-extinguishing exercise, a chance to measure the hardness level of tap water,.

Teams & families celebrating Genk's 60th Anniversary.

Queuing for Aperam Châtelet Open Day.

> In Europe, our community actions used to be less structured and more opportunistic, often modelling along the lines of a National or Regional event, like the "Weeks of the Industry" (see hereafter), or like the October Pink events (against breast cancer), for instance those held yearly in Gueugnon. They can also be very dynamic with family days in big sites, like the traditional Family or Junior Days (like the one gathering the 17-year-old children of our Aperam Genk employees), or more modest versions but equally impactful at our smallest sites (eg. in Amilly in 2022), together with local fairs, "green days" and Christmas events.

In 2022, we initiated a new and more proactive approach as the ResponsibleSteel™ framework requests, with the aim to develop a more systematic and cohesive engagement and development plan in cooperation with local players. We rolled out a pilot, fully embedded into our risk analysis to become a truly operational tool and combined together with guidelines in terms of charitable contributions tailored to the needs of our regions. For instance, the regions that are recognized by the authorities as in need of re-industrialization will benefit from a higher budget, for actions fully aligned with Aperam's values. As part of that, special attention is allocated to marginalised groups such as unemployed women or migrants.
We also decided to use existing reporting tools and expand their coverage to help us structure better our Stakeholder Engagement. In the meantime, we are also starting to disclose our charitable contributions (see table next page and online pages for our main plants for the information by site).
■■■ Our Isbergues platform is a clear example of active local engagement. Not only has the management of the Isbergues platform met with the main association representing local residents (EQVIR) every quarter since 2014, the unit developed special communication tools ("Bulletin de la plateforme d'Isbergues") to inform all stakeholders about what's going on with the several entities (not all Aperam) located within the boundaries of the former XIX century steel plant.They also contribute to the local life through participation to local sportive events and associations.

In 2022, we have a few highlights to report:
> Late November was Industry Week in France. It was the opportunity to talk about Aperam and to attract young candidates. On the Isbergues platform, doors were opened to local school children to promote our industry and we reached out to candidates during a regional forum to present our job openings. We are eager to exchange with professionals and to encourage vocations while breaking down preconceived ideas about industry. Likewise, our "Precision" unit from Pont-de-Roide opened its doors to a group of youngsters in partnership with the association "Elles bougent" (see page 19) to promote technical careers amongst girls and women.
> Almost at the same time, Aperam Châtelet plant opened its doors to welcome 1,200 employees, contractors, local officials and family members. This year's Open Day included guided tours of our operations together with a number of social activities, food trucks and special entertainment for kids. A video summary recorded the event.
> The year 2022 was also marked with 60 years of stainless steel in Genk and 10 years of Aperam on the clock: it was time to celebrate. Aperam Genk organised 2 family days in June for employees and families. In total, almost 2,000 people visited the Aperam Village, built on purpose for the occasion to bring together high quality street food, refreshing drinks, live music. The party also provided access to the "Open Air Museum" workshops of Bokrijk, where one could bake bread or work on leather.

Stakeholder Engagement, the Aperam Way

✓ Official Stakeholder Engagement policy
✓ Group Sustainability report in English
✓ Country supplements in local languages
✓ Entrance Posters and site-specific web pages with key Social & Environmental indicators (right)
✓ Ongoing Environmental monitoring
✓ Stakeholder dialogue directly by sites or via our Acesita Foundation, structuration in progress
✓ Development programs via our Brazilian Foundation and pilots in Stainless Europe
✓ Grievance mechanisms incl. online contact forms
✓ Human Rights/Discrimination risk assessments
✓ Biodiversity partnerships in progress
✓ Monitoring tool in preparation

(All public documentation available at www.aperam.com)

S&S Poland 's team ready for the challenge.

Above: Open Day in October 2022 at Amilly (Alloys & Specialties)..

Employee Survey

76% are proud of Aperam's contribution to the Community

Solidarity with the Ukrainian people

Aperam and its employees showed solidarity with the Ukrainian population.

- Donation: combining those channelled via the immediate Polish S&S unit initiative, with those sent to the special Aperam account and the personal donations made directly to associations, more than 50,000€ were collected in 2022
- Group-level donations will be made in 2023 to reflect our employees' commitment.
- Support provided in Isbergues (4 families were provided with a housing by Aperam and also with Christmas gifts)

■■■ Launched at the end of 2018, France's 'Territory of Industry' initiative aimed to revitalize industry, especially in areas that have experienced significant deindustrialization. The initiative targeted four axes: recruit, innovate, attract projects and simplify. To implement the plan the initiative combined the forces of cities and industrial companies.

Each Territory of Industry had a local project committee, led by an elected-industrial pair whose primary role was to establish stronger links between local authorities, manufacturers, state services and consular chambers. In other words, to build an ecosystem. Our Imphy unit was the industrial member of the team leading the Nevers-Val-de-Loire territory and proved instrumental in building the overall plan, two actions of which were very emblematic of the pooling of our efforts:

- a real estate offer to attract new projects to the area
- attracting and recruiting people from other regions in our local plants

In 2022, the Minister of Industry came to see the success of the Territory of Industry initiative in Nièvre first hand. The Imphy team is proud to have played a role in restoring the image of industry in the area, highlighting how our business is both modern and innovative. Proof of our success can be seen in the fact that Imphy and the Nevers-Val-de-Loire was named one of the nine Territory of Industry initiatives (out of an initial 148) that will continue on to a new three-year cycle . Called 'Industrial Rebound', this cycle aims to support the transformation of the automotive sector, develop projects around hydrogen, and promote the innovation potential of our territory.

Voice

"We can be proud to have helped restore the image of our industry and showed the general public that our business is modern and innovative.

I'm excited that our work will continue during a new three-year cycle!"

Jean-Christophe Trontin
Imphy Plant Manager

Community Investments (Donations)

Donations in k€ by Unit(1)	2022	2021	2020	2019
Aperam in Belgium - All units	31.1	16.7	5.8	9.1
Aperam in Brazil - All units	510.6	424.3	482.2	378.4
Aperam in France - All units	62.6	57.5	32.5	36.8

(1) Excluding donations in kind.

Aperam Acesita Foundation

In 2022, the Aperam Acesita Foundation once again oversaw a number of successful social initiatives, benefiting more than 81,000 people and involving a total investment of BRL 3.9 million in the Steel Valley and Jequitinhonha Valley. The social projects covered the Foundation's four main focus areas (38% education, 38% social development, 13% culture, 10% environment) and were aligned with our ESG strategy and mission of contributing to the local, integrated and sustainable development of communities.

With the pandemic-related restrictions of prior years lifted, but still applying the health and safety protocols, we were able to restart our actions closer to the communities being serviced (while still following all health and safety protocols). Even if our actions remained below pre-pandemic figures, they nonetheless had a big impact either through its various events and through the Aperam virtual channels.

• Education and Training

- Continuous Skills Training for Professionals: to support the continuous self-development in the Vale do Aço and Jequitinhonha regions, we provided qualitative education for professional improvement and updated pedagogical practices. A total of 1,800 professionals benefited from these initiatives, including school general service assistants, teachers, pedagogues and school directors.

- School Complementary Projects: 3,200 students benefited from our traffic safety and drug resistance education programs, both of which were held in partnership with the Military Police. We also partnered with local firefighters on safety training and with the Lawyers from Brazil Association(OAB) on a course about law and citizenship.

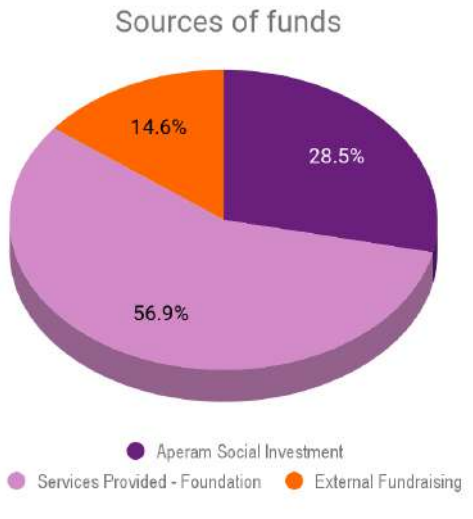
- **Female Empowerment:** the Girls Empowerment and Citizenship project, done in partnership with Itaú Social and the Council for the Rights of Children and Adolescents of Timóteo, developed the potential of female students by providing new skills and teaching about their rights as citizens and gender equality. A total of 163 young women from six schools benefited.

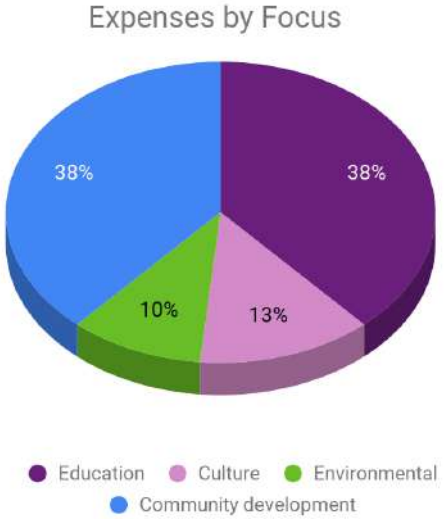
- Strengthening Ecological Awareness: with the goal of raising awareness about environment preservation and conservation, we implemented an Ecological Calendar. The calendar reinforced the responsibility each of us has for the sustainability of the planet by highlighting important dates related to environmental and ecological themes that were celebrated throughout the year, like World Water, Environment, Traffic and Tree Days.
The project also organised ecological walks, school writing competitions and theatrical opportunities for students.
In 2022, 802 people benefited, including employees, teachers, students and communities.

Aperam Acesita Foundation Activity GRI 413-1

Indicator	Unit	2022	2021	2020	2019	2018
Beneficiaries	Unit	>81,000	> 26,001	> 40,000	>65,000	>64,000
Cultural Events		200	60	94	89	102
Online Events (Views)		132(2)	> 61,001	>265,000	n/a	n/a
Social Impact Investments (Social Projects only)	BR$ million	3.9	2.7	1.98	2.3	2.9
Other Aperam Acesita Foundation Expenses		1.5	1.1	0.72	0.9	n/a
Total Investments by the Foundation (1)		5.4	3.7	2.7	3.2	2.9

(1) Including expenses linked to the services provided.
(2) Due to return to face-to-face actions after the pandemics.





- Empowering the Elderly: these actions aimed to support our senior citizens by encouraging healthy habits, raising awareness about physical and mental health issues, and providing social opportunities like dance classes, theatre and choir groups and various physical activities. Almost 3,000 elderly people in the city of Timóteo benefited.

● Professional Qualification

- Industrial

The Steel Institute, which aims to provide professional training, qualified 23 people from the community in welding, finishing and cleaning processes for stainless steel, generating more than 5,000 hours of training. In line with our commitment to diversity and inclusion, 24 women were trained as Steel Operators Welders, (5,000hours of qualification) with a focus on preparing them for potential employment opportunities at various regional industries, including Aperam Stainless. More than 70% of the women trained were already employed in the metalworking sector by the end of 2022. The same strategy has also been applied for training Steel Operators with physical disabilities, with more than 10,000 hours of training provided to 30 employees.

- Rural

With the goal of improving the quality of life for those living in rural areas, and in partnership with SENAR (National Rural Learning System) and Rural Unions, we provided 754 people with more than 20,000 hours of training in Vale do Aço and Vale do Jequitinhonha. Training covered such topics as revitalising degraded areas, maintaining brush cutters, building an ecological septic tank, beekeeping, recycling plastic bottles, cutting and sewing, amongst others.

● Culture

Contributing to the cultural strength of the communities where Aperam operates, 200 different events were held, including children's and adult's theatre, musical and dance shows; art exhibitions; outdoor activities; and educational lectures. We also provided workshops on organising and promoting cultural events. A total of 555 local artists and more than 50,000 spectators participated in the various cultural offerings.

● Public Notice for Social Projects

Through its own resources, 23 new projects were approved in the Vale do Aço and Vale do Jequitinhonha regions. These new projects are focused on generating employment and income opportunities, strengthening the solidaire economy, enhancing formal educational process, and empowering associations and communities in general. Community Associations, cultural associations, women's associations, and school funds, among others, from the financial contributions and technical support these projects provided, directly benefiting almost 3,000 thousand people.

● Project Notice - Environmental Initiatives

Also using its own resources, the Public Notice for projects with a focus on the environment has been put in place to support social organisations working to develop environmental technologies and generate a positive socio-environmental impact on the communities located in the areas covered by Aperam BioEnergia. Support was given to 11 initiatives organised by various social organisations, including community associations of small rural producers, Quilombola's associations, cultural associations and residents' associations. Nearly 3,300 people in the Jequitinhonha Valley region benefited from these initiatives.

For more information (in Portuguese), please visit: http://brasil.aperam.com/sustainability/fundacao-aperam-ace sita/a-fundacao/

A Focus on Sustainable Innovation

Our mission is to provide innovative steel and alloy solutions that are affordable, long-lasting, and that offer the strength and versatility our customers have come to expect. That's why we place a particular focus on growing our portfolio of high-value added products and solutions. For example, we continue to develop innovative products through our research and development initiatives, while also leveraging our marketing and communication efforts to expand our brand recognition and grow our market share.

Sale of New Products by Category

Index, based in volumes	**Base**	**2022**	**2021**	**2020**	**2019**
Stainless Steels	2019	76	69	58	100
Electrical Steels		247	261	92	100
Special Carbon Steels		154	69	131	100
Alloys	2020	554	168	100	n/a

Employee Survey 2022

8.1/10 agree that we actively study customers' requirements and expectations

Note: after a certain amount of time (e.g., 5 - 7 years), a product can no longer be considered 'new', which explains the decrease in 'new' projects seen in 2020.

Yet while we are intent on growing, we want to ensure we do so sustainably. To do this, we are dedicated to producing products and solutions that both drive a circular economy and enable the sustainable world our future demands

Answering Tomorrow's Challenges Today

Whether it be electric vehicles, renewable energy or addressing the challenge of climate change, many of today's megatrends are acutely focused on sustainability. But to be truly sustainable, these solutions must be sustainable themselves – and that means being made of materials that support the circular economy and that can go the distance.

100% recyclable, inherently reusable, durable, resistant to corrosion, hygienic, easily formable and offering excellent mechanical strength – not to mention being competitively priced – stainless steel has emerged as the material of choice for megatrends, which means big opportunities for companies like Aperam.

To leverage this opportunity, Aperam has launched new business programs to position ourselves as a leading actor in the megatrends arena. Megatrends will shape our world for a long time, which is why Aperam is dedicated to working with our customers to develop the innovative solutions that will drive these trends.

The Innovative Materials Behind the Mobility Revolution

The mobility and transport sector is moving full steam towards full decarbonization. In the last few years, key decisions have been made to accelerate this shift. For example, in May 2023, EU Member States adopted legislation phasing out sales of internal combustion engine cars and vans by 2035. The International Maritime Organization agreed to aim for a reduction of annual GHG emissions from international shipping by at least half by 2050, compared to their levels in 2008.

Automotive, rail, aviation, maritime… all of these major industries are subjected to ever growing pressure to go green. Answering this pressure will require the use of innovative new materials. Overall, Aperam is committed to supporting the transition towards sustainable mobility and transport through our innovative materials solutions, including in these three areas that we see as being ripe for disruption:

- **SHIFT TO ELECTRIFICATION:**

  The sale of electric vehicles is set to skyrocket in the next few years, from 1.4 million in 2022 to 11 million in 2030 and 16 million in 2035 (Europe), and from 752 000 in 2022 to 5 million in 2030 and 8 million in 2035 in the US (IHS Markit).

  Connected cars will account for 100% of the market by 2035. Aircraft will become more and more electric, increasing the percentage of systems that are powered electrically.

Voice

"These developments open the door for new opportunities for Aperam and the materials we produce.

Whether it be electrical steel for e-motors, stainless steel for battery parts, and alloys for high-efficiency e-motors, power electronics, and battery components - Aperam is ready to deliver".

Gwenaëlle Le Meur
Director New Business – Mobility & Transport.

- **DEVELOPMENT OF HYDROGEN MOBILITY:**

  According to the International Energy Agency, there are 50 national targets, mandates and policy incentives in place today that directly support hydrogen. The majority of these are focused on transport.

  Thanks to its unique properties, stainless steel is being used to store hydrogen in cryogenic tanks, and produce bipolar plates for fuel cell vehicles.

- **THE DECARBONIZATION OF TRANSPORT:**

  The Green Transition and various regulations supporting this transition will cause fundamental change to the materials used in the shipping, trade, offshore and energy sectors. For example, governments have agreed to adopt a revised and strengthened set of climate goals at the 80th session of the Marine Environment Protection Committee (MEPC80) in July 2023.

  Within the maritime sector, alloys are the material of choice in applications for on-shore supply, while stainless steel is favoured for CO_2 scrubbers and NOX selective catalytic reduction.

Sustainable Solutions for the Food & Beverage Sector

Aperam's focus on megatrends is by no means limited to the transportation sector. The company is dedicated to developing sustainable solutions to some of society's most pressing problems – including the use of plastic packaging.

To position stainless steel as a sustainable alternative to the plastic packaging used in grocery stores, we recently partnered with Berny to design and develop a returnable and reusable stainless tray to get your meat, poultry, and fish products packaged. "This project is an excellent example of how our research and innovation initiatives leverage the strengths and capabilities found across the company and within our network of partnerships," says Saghi Saedlou - Head of Stainless Steel Research, Europe.

Voice

"Aperam also contributed to NF norm D21-304, which defines the conditions for microwaveable stainless steel. The use of stainless steel and the shape of the final product are crucial for compliance.
We saved Qwetch time in developing their certified food container, allowing them to be among the first to introduce a sustainable microwaveable alternative to plastic food containers."

Saghi Saedlou
Head of Stainless Steel Research, Europe

Building Better with Stainless Steel

Beyond the Food & Beverage sector, stainless steel has become the material of choice for the building and construction sector.
To help this sector comply with new obligations on the use of low carbon and circular-friendly building materials, Aperam has developed a robust pipeline of stainless solutions for use with building roofs and facades, all of which offer an unprecedented level of durability, a long lifespan and are infinitely recyclable.

Considering that, in Europe, buildings account for 40% of the EU's total energy consumption, Aperam is also developing solutions to help buildings and homes become more energy efficient.

For example, with the use of thinner stainless steel, brazed heat exchangers can get better heat exchange and thus offer better performance.

Stainless steel is also used to help insulate windows - a key step to improving the overall efficiency of a home or office.

Customer Satisfaction

Indicator	Unit	2022	2021	2020	2019
Customer satisfaction: Alloys	Rate on 10	n/a	9.15	n/a	8.8
Customer satisfaction: Stainless		7.0 - 7.8(2)	7.9 (1)	8,0(1)	n/a

(1): Brazil
(2) Specific countries in Europe: Italy, Spain, Portugal, North-Africa, Poland, Czech Republic.

Customer satisfaction remains a top priority, and something we measure via our customer satisfaction surveys. In 2022, several surveys have been conducted, giving an average rate from 7.0 to 7.8 depending on the countries.

The Energy Transition

To fit with our climate objectives, today's energy system must be deeply transformed within the next decade:

- **CONSUME LESS AND BETTER**

  → Increase energy efficiency by a third by 2030(1) and phase out from fossil fuels, leveraging on electrification
  Aperam is partnering with customers to produce solutions that consume less energy and improve efficiency. Heat exchangers and water storage tanks are being boosted in the commercial and residential markets by the fast development of heat pumps. Stainless and alloys are critical for the emergence of those markets. Energy efficiency and electrification are key words for the industry.

  A few examples: Efficient motors and compressors (Non Grain Oriented electrical steels or NGO), water desalination plants use important volumes (stainless steel), recovery of heat in the industry processes (stainless steel), etc.
  (1) *Source: International Energy Agency, Net Zero Scenario*

- **PRODUCE GREENER**

  → Transition from 80% fossil fuel to 80% low carbon energies, with remaining emissions being captured and stored.
  Stainless steel can also play a leading role in the shift to greener sources of energy – and Aperam is at the forefront of this transition too.

Voice

"I think Aperam can bring a lot to the energy transition, and that the energy transition represents a great opportunity for Aperam.

For example, to help reduce the use of fossil fuels from 80% to 20% by 2050, Aperam is developing a range of applications for generating renewable energy (geothermal, concentrated solar power, solar Photo-Voltaic, offshore wind), creating nuclear energy, capturing CO2 – and more".

Gilles Bourgain
Director New Business - Energy Transition.

- **TRANSPORT & STORE EFFICIENTLY**

  → Build the infrastructure needed to efficiently and sustainably transport, distribute and store green energy from source to switch.
  Stainless steel and alloys are crucial to creating the infrastructure required to transform, transport, distribute and store energy. Electrification will develop massively globally because electricity is a vector enabling the use of green energy in a number of sectors.

  Aperam's zero CO_2 Grain Oriented electrical steels (GO) will play an important role in producing efficient power transformers. A good way to transport large volumes of energy over long distances is to transport it through liquid gas (natural gas, biogas, e methane, H_2). Stainless and Alloys are critical to store liquid energy in large vessels at very low temperature. The electrolysis process to produce H_2 also requires high resistance materials. Aperam is set to play a leading role in providing long lasting materials for bipolar plates and electrodes of the different electrolysis technologies.

Aperam also carefully monitors emerging markets to identify opportunities for new partnerships and joint ventures.

Whether it's the sustainability-oriented megatrends of today or the emerging trends that will define tomorrow, Aperam has the solutions, the experience and the expertise our customers need to navigate a changing world.

About this Report

This report is based on Aperam figures and inspired by the following initiatives: United Nations Global Compact; Carbon Disclosure Project; ISSF Sustainable Charter; WorldSteel Sustainable Charter, ResponsibleSteel™ principles ; and the Global Reporting Initiative (see Index below). Other GRI-related references are within our Online Supplements.

GRI Index	Disclosure code	Reference
All indicators	3.3	Disclosure on Management of Material Topics - Online Supplement C.
Economics		
Economic Performance	201-1	Direct economic value generated & distributed - p. 6 - 7, 50.
Procurement Practices	204-1	Proportion of spent on local suppliers at main sites - p. 50, 52.
Anti-corruption	205-2	Communication and training about anti-corruption policies and procedures - p. 53, 55.
	205-3	Confirmed incidents of corruption and actions taken - p. 53, 57.
Environmental		
Material	301-2	Recycled input materials used - p. 31, 39, 40.
Energy	302-3	Energy intensity - p. 31-33, 35.
	302-4	Reduction in energy consumption - p. 34, 35.
Water and Effluents	303-3	Water withdrawal - p. 31, 38.
	303-4	Water discharge - p. 31, 38, 41.
	303-5	Water consumption - p. 31, 38.
Waste	306-1	Waste Generation and Significant Waste-related impacts - p. 39, 40.
	306-2	Waste by type and disposal method - p. 31, 39, 40
	306-3	Waste generated - p. 31, 39.
Biodiversity	304-1	Operational sites owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas - p. 43-45.
Emissions	305-1	Direct (Scope 1) GHG emissions - p. 31- 33.
	305-2	Energy indirect (Scope 2) GHG emissions - p. 31-33.
	305-3	Other indirect (Scope 3) GHG emissions - p. 31, 34.
	305-4	GHG emissions intensity - p. 33-35.
	305-7	NOx, SOx and other significant air emissions - p. 37.
Labour		
Occupational Health & Safety	403-1	Health and safety management, assessment, consultation, training, prevention - p. 14, 15.
	403-5	Worker training on occupational health and safety - p. 14, 15, 26.
	403-9	Rate and gravity of injury, occupational diseases, lost days, absenteeism, number of work related fatalities, by region and gender - p. 14, 15.
Training & Education	404-1	Average hours of training per year per employee by gender, and by employee category - p. 14-16, 25, 26.
	404-3	Percentage of employees receiving regular performance reviews, by gender and by employee category - p. 23.
Diversity	405-1	Diversity of governance bodies and employees - p. 19, 21, 23 and Annual Report 2022 (Board of Director and Leadership Team) - p. 67-75, 77, 82.
	405-2	Ratio of basic salary and remuneration of women to men - p. 20.
	406-1	Incidents of discrimination and corrective actions taken - p.53
Supplier Assessment for Labour Practices	414-2	Significant actual and potential negative impacts for labour practices in the supply chain and actions taken: Present report - p. 51-52.
Society		
Local Communities	413-1	Operations with local community engagement, impact assessments, and development programmes - p. 48, 50, 60, 61.

General Standard Disclosure		Information or comment and Reference (page number)
The organisation and its reporting practices		
GRI 2.1	**Organisational details** (Location of headquarters, Local operations, Ownership and legal form)	Aperam Cover and Back Cover., 2022, p. 14-18, Public limited company in Luxembourg.
GRI 2.2	**Entities included in the organisation's sustainability reporting**	Aperam Annual Report 2021, p. 185. ELG is partially covered in the current report, unless otherwise mentioned (as mentioned in the first page caveat note, p. 2). Specifying the differences between the entities included in the organisation's sustainability reporting and financial reporting
GRI 2.3	**Reporting period, frequency and contact point**	Calendar year 2022 (Annual) is reported in the Made for life Report 2022. Previous issue reported on calendar year 2021. sustainability@aperam.com or contact@aperam.com
GRI 2.4	**Restatements of information**	Restatements may result from: Mergers or acquisitions, change of scope of segments, base years or periods, nature of business, measurement methods and tools. Thus, 2021 Aperam financial figures by Divisions have been reevaluated in line with the new organisation further to the creation of Aperam Recycling & Renewables.
GRI 2.5	**External assurance**	Main report, and online supplement bundle. Current report, p. 2.
Activities and Workers		
GRI 2.6	**Activities, value chain, and other business relationships** (Markets served, Scale of organisation, Supply chain)	Aperam Annual Report 2022 p.12-18, 48--55, Current report p. 7 and Annual Report 2022 p.19, 31--32, 152., 2022 p. 12, 114 and 209., Online Supplement C – p. 1, 2. Purchased ELG, partially covered in this report, p. 12 and Annual Report 2022 p. 12.
GRI 2.7	**Employees**	Employees: Figures based on FTE as of December 2022, Full time own employees at year-end excluding Haven Genk. A small portion of the workforce at BioEnergia in Brazil is subject to variations due to seasonal factors (growing cycle of the trees: planting, harvesting etc.).
Governance		
GRI 2.9	**Governance structure and composition**	Current report, p. 11, Annual Report 2021, p.68-88.
GRI 2.22	**Statement on sustainable development strategy (by the CEO)**	Opening Words. Current report, p. 4-5.
GRI 2.23	**Policy commitments**	Values in Current report, p. 9, Aperam Code of business conduct – available on the web in multiple languages.
GRI 2.26	**Mechanisms for seeking advice and raising concerns**	Annual Report 2022 p. 97, Current report p. 55. advice about ethical and lawful behaviour, and organisational integrity' has been changed to 'advice on implementing the organisation's policies and practices for responsible business conduct'
GRI 2.28	**Membership association**	EUROFER, Brazil Steel Institute, ISSF and WorldSteel. Annual Report 2022, p. 61, ResponsibleSteel, Aperam Foundation, 2022 p 60-61
Stakeholder engagement		
GRI 2.29	**Approach to stakeholder engagement** (Stakeholder groups, Identification and selection of stakeholders)	Description of our Stakeholders groups as well as our reporting process and materiality analysis is to be found within our Supplement C. Current report, p.11, 12, 58 and further, and Supplement B.
GRI 2.30	**Collective bargaining agreements**	100% of the Aperam employees are covered by collective bargaining agreements

Disclosures on material topics		
GRI 3.1	**Process for determine material topics**	In line with the GRI framework. Current report, p. 12, Supplement B. Description of our Stakeholders groups, reporting process and materiality analysis to be found within our Supplement C
GRI 3.2	**List of material aspects**	Current report, p. 12, Supplement B p. 1. Description of our Stakeholders groups, reporting process and materiality analysis to be found within our Online Supplement C.
GRI 3.3	**Management of Material Topics**	See our Risk Management in Current report, p. 53 and Annual Report 2022 p.52--54.

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www.aperam.com/sustainability

Aperam Becomes First Stainless Steel Company to Earn ResponsibleSteel™ Certification

2023 © Aperam

aperam™ infinite

Press release

September 27, 2023

Aperam launches its new sustainability brand for all its near-zero* footprint premium products, related services and solutions – Aperam infinite™. Achieving a reduction of up to 85%[1] in carbon emissions compared to the industry average.

Helping customers to reduce their total carbon footprint, particularly in scope 3, and join the circular economy.

"We have transformed Aperam to provide sustainable, high quality stainless steel and specialty alloys at the scale the world needs. Welcome to an infinite world, full of opportunities and possibilities."

Tim Di Maulo, CEO, Aperam

The company is a world leader in stainless, electrical and specialty steel production, known for its total commitment to sustainability and goal of contributing to global carbon neutrality by 2050. Central to transforming its business in Europe was the integration of ELG, a leading recycling company in 2021. Today, Aperam stands out as the sole fully integrated stainless steel producer capable of recycling large volumes of high quality scrap materials without compromising quality. It is the only truly circular economy player active in the transformation of the stainless steel industry.

Stainless steel – the perfect material for meeting the world's sustainability challenges now and in the future

Stainless steel meets the requirements of the three axes of the circular economy – durability, recyclability and sustainability. It's corrosion-resistant, durable and has an almost infinite life compared to other materials. The world is hungry to develop – stainless steel is the way to do this sustainably.

We've chosen the name 'infinite' for our near-zero* product range because stainless steel is infinitely recyclable, infinitely usable, infinitely adaptable and ultimately, we believe, infinitely good.

*Up to 50% below existing Aperam production (scope 1+2+3 upstream) with the aim of achieving zero carbon emissions

1 Ref. 304 stainless steel – calculation based on currently agreed 6tCO_2e/t eq. carbon in imported stainless steel

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Aperam infinite™ is a promise to customers to deliver high quality products and solutions produced in the most sustainable way.

Aperam infinite™ is designed with customers and end users in mind. It offers many benefits including:

- An accelerated path to help customers achieve their CO_2 reduction goals, including scope 3 emissions, enhancing their sustainability credentials.
- An opportunity for customers to use more recycled materials in making their products, thanks to Aperam's closed loop process.
- The ability to offer consumers products that have a low environmental impact and a high proportion of recyclable material.
- By partnering with Aperam, customers can maximise the value of their scrap by selling high purity, well sorted material to the company's recycling and renewables division, embracing a complete circular model.
- Additional benefits include brand protection, differentiation from competitors and support in helping customers comply with regulatory requirements.

Closing the loop

Aperam infinite™ closes the loop between a transformed Aperam, ready and able to play its part in delivering industry solutions, and customers who are serious about making sustainability and the circular economy happen.

Aperam infinite™ is made with up to 98% scrap content in Europe

85%[1] reduction in CO_2 emissions compared to industry standards of 6tCO_2e/t

Aperam leverages cutting edge expertise, innovation and best practices to manufacture Aperam infinite™

Aperam infinite™ benefits from the company's advanced expertise in scrap utilisation and its ongoing research in the most sustainable energy sources. It has made a substantial contribution to these breakthroughs by providing:

- Expertise in scrap collection, sorting and processing by Aperam Recycling, which now achieves an annual collection rate of 1.3Mt of recycled raw materials.
- Usage of renewable energy resources such as hydroelectricity, photovoltaics and wind power.
- Usage of charcoal biomass derived from the company's FSC®-certified BioEnergia forests in Brazil.
- Investments in pioneering research activities such as Botanickel, a bio-mining process that extracts nickel from industrial soils.

1 Ref. 304 stainless steel - calculation based on currently agreed 6tCO_2e/t eq. carbon in imported stainless steel

About Aperam

Aperam is a global player in stainless, electrical and specialty steel, with customers in over 40 countries. As of 1 January 2022, the business is organised in four primary reporting divisions – Stainless & Electrical Steel, Services & Solutions, Alloys & Specialties and Recycling & Renewables.

Aperam is a leader in high value specialty products. It has built an integrated distribution, processing and services network. It has a unique capability to produce near-zero carbon footprint stainless and specialty steels from biomass, high quality stainless steel scrap and high performance alloys scrap.

Aperam places sustainability at the heart of its business, helping customers worldwide join the circular economy. It is the first player in its market to be ResponsibleSteel™-certified in Europe and the Americas. Its sustainability efforts have received wide recognition.

Aperam in figures

- EUR 8,156 million sales and shipments of 2.31 million tonnes in 2022.
- 2.5 million tonnes flat stainless and electrical steel capacity in Brazil and Europe.
- Over 100 large-scale projects completed reducing scope 1 and 2 emissions.
- Carbon footprint of 0.32[1] CO_2 /ton of crude steel – well below 0.9[2] CO_2/ton sector average.
- Ambitious 2030 goals aim for -30% GHG on scopes 1+2 and -11% energy consumption (base 2015), and enhancing air quality and water management.
- Aperam subscribes to 10 Sustainable Development Goals (SDG) as part of the UN open source initiative. These include four environment goals, three social and three governance goals.
- 25% of Aperam's global workforce is involved in process innovation to improve energy efficiency, quality and CO_2 reduction. Aperam is also recognised for its best employer scores.

Aperam places sustainability at the heart of its business, helping customers worldwide join the circular economy

1 Scopes 1+2, including the sequestration effect of Aperam's Brazilian forests

2 Scopes 1+2

For further information, please visit **aperam.com**

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material content rate of 94%, incl. steel scrap and waste streams from our production. In comparison, a recent study by the Yale University showed that the global average of recycled content is only 44%.

However, durability is also important. Manufacturing something only once, instead of twice or even three times during a certain time period, due to breakdowns and repair, is of course less resource consuming. Stainless steel helps to prolong the lifetimes of applications, for example bridges susceptible to corrosion, or components like exhaust pipe systems in cars.

A study by Boston Consulting Group on the CO_2 emissions related to the six relevant uses of steel revealed that CO_2 savings in the use phase are six times the CO_2 needed to produce the steel.

Low life-cycle costs for stainless steel

The durability of stainless steel also has a cost-effective impact from a life-cycle perspective. Stainless steel requires only minimal maintenance, which is both economical and good for the environment and society. The combination of corrosion resistance and durability increases product lifetime. In certain cases, these cost savings can be in the range of 30% to 40% compared to alternative materials, and they arise from reduced repair and maintenance costs.

Overall life-cycle impact of our products

The strengths of Outokumpu’s stainless steel are especially visible from a life cycle perspective. By paying more attention to life cycle oriented environmental management and conducting several life cycle inventory studies we have been able to point out and act on the most efficient ways to reduce the overall life cycle impact of our products.

The use of Outokumpu's steel in modern society minimizes emissions by creating efficiency in, for example, transport, construction and energy production. Thus, Outokumpu’s stainless steel supports prosperity and health. Other means of, and our strengths in, reducing our environmental impact are:

- Efficiency in energy use
- Choice of electricity sources
- Material efficiency in production

In **energy efficiency**, Outokumpu is taking a long-term approach: the target is a continuous improvement of a 0.5% reduction yearly.

In choosing **electricity sources**, Outokumpu participates in low-carbon electricity production, such as new power plant projects, and enters into agreements with parties in the power market, contributing to the future construction of adequate power production capacity.

ACCIAI
SPECIALI
TERNI

Information to our customers concerning

Recycled Scrap content in Stainless Steel

Acciai Speciali Terni regards environmental and climate protection and the responsible use of energy and resources as important objectives and part of our sustainable corporate strategy.
When developing new products and services, selecting suppliers and products in procurement processes and in our operating processes we ensure that all resultant environmental impacts and the use of energy and natural resources are kept to a minimum.
In our Company environmental protection, energy efficiency and the conservation of resources is a task for everyone.
We comply with our binding obligations.

Reducing Raw Material Resources Extraction:

Acciai Speciali Terni is working to increase the use of scrap recycled in its production. Now the total recycled content in our steels, based on last fiscal year production, is up to 893t on 1000t of liquid steel produced, depending on scrap availability.

Terni 18/11/2020

Acciai Speciali Terni S.p.A.
con Unico Socio
Sede Legale:
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info.ast@acciaiterni.it
www.acciaiterni.it
Iscr. Reg. Impr. TR e Cod. Fisc.11222300151
P. IVA 00715760559
Cap. Soc. € 159.682.400 i.v.

Unità Operative:
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Strada dei Confini 48, 05100 Terni
T. +39 0744 8091 - F. +39 0744 809273
Strada di Sabbione 91/A, 05100 Terni
T. +39 0744 808251
Strada di Pentima 3, 05100 Terni
T. +39 0744 2031

Uffici Commerciali:
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Via Milano 12, 20816 Ceriano Laghetto (MB)
T. +39 02 969821 - F. +39 02 96982381

ACCIAI
SPECIALI
TERNI

ASSERZIONE AMBIENTALE AUTO DICHIARATA

I prodotti in acciaio inossidabile dello Stabilimento di Terni di Acciai Speciali Terni S.p.A. con Unico Socio, sono realizzati con il recupero di rottami di provenienza esterna, il riciclaggio di scarti interni e l'utilizzo di Ferro-Leghe. I contenuti di materiale riciclato pre-consumatore e post-consumatore riportati nella tabella seguente sono calcolati secondo la norma UNI EN ISO 14021.

SELF DECLARED ENVIRONMENTAL CLAIM

Stainless steel products from Terni Plants of Acciai Speciali Terni S.p.A. con Unico Socio, are made employing recycled material, internal scrap and Ferro-Alloys. Contents of pre-consumer and post-consumer recycled materials reported in the table below are calculated according to the UNI EN ISO 14021 standard.

	Contenuto riciclato totale Total recycled content	Pre – consumatore Pre - consumer	Post – consumatore Post - consumer
Acciai Austenitici Austenic Steel	**74.1 %**	**65.9 %**	**8.2 %**
Acciai Ferritici/ Martensitici Ferrirtic/Martensitic Steel	**72.9 %**	**20.3 %**	**52.6 %**
Periodo di riferimento Ottobre 2018 – Aprile 2019 Reference period October 2018 - April 2019			

Acciai Speciali Terni
Paolo Zanella

Responsabile Sistema Qualità
System Quality Manager

Terni lì 30/05/2019

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EUROFER
THE EUROPEAN STEEL ASSOCIATION

Guidance paper

Using the standard EN 19694-2 and appropriate thresholds for the use of scrap for an EU Taxonomy fit for purpose

We need a taxonomy that will help raising funds for sustainable projects and support activities which will contribute to carbon neutrality in the EU by 2050

Publication date: 21 October 2020

Overview

Massive transformative investments are needed for the development, demonstration and scaling up of new CO_2-low technologies over a relatively short time period. The sustainable finance taxonomy should facilitate the transition and therefore maintain a flexible approach that prevents prescriptive and rigid categories which do not take the dynamic evolution of technology into account. The transition of the steel sector will not be linear, but will rather require step changes and investment spanning over several decades. **EUROFER has provided a detailed position on the EU taxonomy for sustainable finance in its contribution to the inception impact assessment on the EU taxonomy**[1], highlighting the following main requests for the technical screening criteria:

- The EU taxonomy should use genuinely an integrated lifecycle approach to take into account steel as an enabler for CO_2 mitigation in multiple value chains.
- The principles of standard EN 19694-2, developed with a mandate from the EU Commission, shall be used to assess relative performance instead of ETS benchmarks, which do not entail a lifecycle approach and are thus not suitable for the taxonomy purpose.
- Secure the eligibility of EAF steel production without excluding different steel qualities, like stainless steel, and high alloy steel[2] due to the proposed threshold of at least 90% scrap sourced iron content in final products.

[1] EUROFER contribution to inception impact assessment on EU taxonomy, October 2020 (https://www.eurofer.eu/assets/Uploads/20200421_EUROFER_Contribution_IIA_Taxonomy_Final-1.pdf)

[2] Definition following in accordance with Commission decision (2011/278/EU) of 27 April 2011 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council

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- Add CCU and CCS to the list of low carbon breakthrough technologies and take all sources of hydrogen - as well as from iron and steel production – into consideration.

We reiterate our call for consideration of the above requests and would like with this short paper to further clarify only two points: our request for using of the EN 19694-2 in place of the ETS benchmarks and for the modification of the threshold for the use of scrap in the technical criteria for the EU Taxonomy.

EN 19694-2 in place of ETS benchmarks

The steel value chain is a complex system of interconnected processes producing steel essentially via 2 complementary process routes:

- the primary production route based on Blast Furnace – Basic oxygen Furnace using iron ores, steel scrap, and mainly fossil based reduction chemicals and energy carriers (coke).
- the secondary production route based on Electric Arc Furnace using steel scrap and mainly electricity.

We would like to reiterate that, in order to understand and assess/evaluate the environmental impact of activities of the steel industry, the entire life cycle needs to be taken into consideration, this in line with Article 19 (g) of the regulation[3]. As part of a life cycle approach, it is key to assess the performance along the entire steel value chain, including all inter-connected steelmaking processes, in order to have consistent data and avoid misleading results which would compromise the existence of sustainable steel value chains in Europe.

ETS benchmarks are not able to evaluate the environmental impact of the activities of the steel industry as they do not consider the interconnected processes that make up the steel value chain. Therefore, EUROFER has been urgently calling for an effective use of the standard EN 19694-2 [4].

EN 19694-2 was developed with a mandate from the European Commission. Under mandate M/431[5] of October 2008, a gap analysis of EN and ISO and international protocols was carried out. The results of this work indicated *"the need for further standards to facilitate and support the implementation and development of EU and international climate change policy actions".*

As follow-up the mandate M/478[6] of December 2010 was delivered by the Commission with the objective to *"create a European standard (one generic standard with sector-specific annexes) that*

[3] Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088 (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R0852&from=EN)

[4] EN 19694-2: Stationary source emissions - Greenhouse gas (GHG) emissions in energy-intensive industries – Part 2: Iron and steel industry (published in 2016)

[5] Mandate M/431 – Mandate addressed to CEN to establish a programme of standards for assessing the greenhouse gas (GHG) emissions in energy-intensive industries (https://ec.europa.eu/growth/tools-databases/mandates/index.cfm?fuseaction=refSearch.search&lang=en#)

[6] Mandate M/478 - Standardisation mandate to CEN, CENELEC and ETSI for the development of EU technical standards in the field of greenhouse gas emissions

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will support policies and measures set up for moving towards a global low emission economy. [….] One main goal [of the standard] is to encourage performance improvements of industrial installations, e.g; by increasing efficiency and reducing emissions. GHG emissions standards, notably, are to play a prominent role in promoting EU enterprises' long term competitiveness and help seizing the opportunities of the green economy."

Under the mandate of the Commission, a generic standard was developed, including the part EN 19694-2 for steel, which sets out the CO_2 accounting rules and metrics aimed at carrying out an emissions assessment. This includes the CO_2 emission performance assessment of steel production facilities, whilst taking into account and properly addressing potential distortions due to differing production facility layouts. To this end, this standard goes beyond the 'birds eye' CO_2 intensity approach (aggregated CO_2 inventory) by determining the performance of each process unit as part of a defined production value chain. This helps to identify the strengths and weaknesses along the value chain (performance assessment) in comparing CO_2 emissions or energy use with a reference.

Furthermore, within that mandate of the Commission, the generic standard (and its sector specific parts) **was successfully verified through field tests conducted by well-known institutions such as TÜV in Germany (for the field tests of EN 19694-2 for steel)**.

We welcome that the Final TEG report [7] proposes that technical screening criteria for "Manufacture of iron and steel" should be based on **standard EN 19694-2**, which would **allow the consideration of the steel value chain as a whole**.

However, even if the report proposes to base the screening criteria on the standard EN 19694-2 for the manufacture of iron and steel, it still recommends to use the ETS benchmarks because the report deems those benchmarks reliable and considers them as "the only consistent data today". It should be noted that the reference values included in the standard EN 19694-2 are based on the analysis of a set of reliable technical data of 60 steel facilities (with detailed information at single process levels) over a period of six years, are consistent as well.

The standard EN 19694-2 gives visibility not only for CO_2 emissions but also for energy consumption and efficiency at a much higher level of granularity. This is an important added value because it ensures that those two related elements (energy efficiency and CO_2) are consistently addressed. This will positively contribute to well-informed discussions with different stakeholders, since this level of transparency is not always forthcoming (some non-EU regions do not give visibility to both energy and CO_2 emission performances, because they focus more on energy efficiency while being less efficient in CO2 emissions performance).

The reference values (for CO_2 emissions and energy) for each process have been set by the best 25% of the distribution curves of CO_2 or energy intensities. This means that 87.5% of each single

(https://ec.europa.eu/growth/tools-databases/mandates/index.cfm?fuseaction=search.detail&id=463#)

[7] The final report on EU taxonomy, developed by the Technical Expert Group (TEG) on Sustainable Finance and its technical annex, published in March 2020 (https://ec.europa.eu/knowledge4policy/publication/sustainable-finance-teg-final-report-eu-taxonomy_en)

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process must improve its operation to reach the reference[8]. The standard foresees a regular update of the reference values. The reference values are not per se higher than the ETS benchmarks, which target direct emissions. It should be noted that the reference values include indirect emissions (from electricity and utilities) - leading to "processing performance indicators"; or indirect emissions and utilities as well as upstream emissions – leading to the "total performance indicators". This gives a more comprehensive assessment of CO_2 emission and energy performance, and can at the same time, be put in relation with ETS benchmarks.

Practical implementation of EN 19694-2

The standard is also already formulated as an Excel tool ready for use and publicly available on the EUROFER website[9]**.** It delivers not only quantitative results (per steel product, process, and site), but it also provides a report in the form of graphs, which allows a deep analysis of the impact of various measures applied at the different single process levels. This helps to identify the existing improvement potential for reduction of CO_2 emissions and energy consumption – which contributes to development of effective decarbonisation strategies, as weaknesses and strengths at each stage along the value chain can be analysed.

Using the standard increases transparency and ensures equal treatment of the operators/companies because the standard has high granularity, clear definitions and a clear set of calculation rules. The excel tool helps ensure that reliable data are being used because it performs the data quality checks and reports on carbon and energy balances along different stages of the value chain.

Operators will only have to fill in the template (excel tool) with their data. The excel tool will calculate the intensities and performances against the references and the results will be reported at different stages of value chain depending on the configuration of the site/facility chosen by the operator to reflect the value chain relevant to his operations. Results are being also provided for the entire site as a summary of the impact of different process stages. In particular, the report helps to see the impact of a given measure on the overall performance of the site regarding CO_2 emissions and energy efficiency. This provides information about the effectiveness of the intended action or requested investment – which is an added value for decision taking.

The burden of the work falls to the operator, who has to deliver the necessary information.

Financial institutions can use the results from the excel tool to assess the effectiveness of the investment on the individual process performance as well as on the performance of the overall value chain (emissions per tonne of steel product). Eligibility will be achieved if the investment leads to the installation being at/or below the reference (Reference Value).

[8] An average set by 25% lowest CO_2 emitting installations means that only 12.5% of the installations may be below or at that average while 87.5 % will be above the average

[9] Excel tool for European Standard EN 19694-2 (https://www.eurofer.eu/publications/reference-documents/excel-tool-for-european-standard-en-19694-2)

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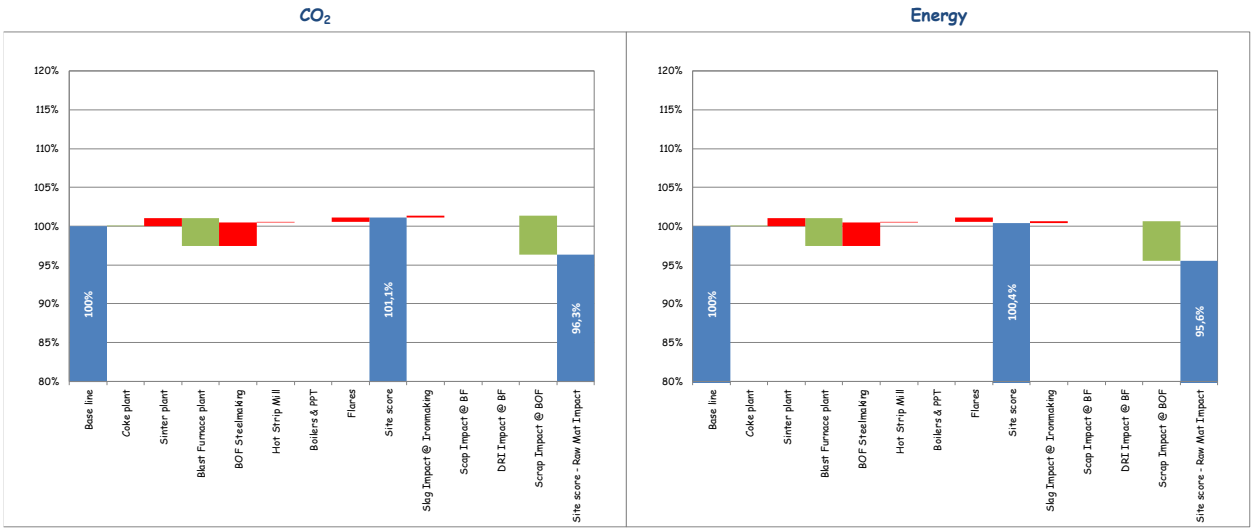
In summary the EN 16964-2 offers the following advantages over using the ETS benchmarks:

- A more comprehensive assessment of both the CO_2 emissions and energy efficiency taking into account interconnected processes and upstream impacts.
- An inclusive and transparent assessment of the reduction potentials within the whole steel value chain.
- Challenging, realistic and achievable eligibility criteria which incentivises the most effective investments for CO_2 emission reduction.



Example of results from the excel tool in waterfall form (the results are also delivered for the intensities in tCO_2/t or GJ/t, also for the different production steps)

Threshold for scrap usage

We welcome that the technical screening criteria for sustainable contribution to climate change mitigation as proposed in TEG report provides the principle that *"secondary production of steel (i.e. using scrap steel) is considered eligible due to significantly lower emissions than primary steel production"*.

Furthermore, the report suggests that "*all production of steel in EAF where at least 90% of the iron content in the final products is sourced from scrap steel is considered eligible. In this case, no other thresholds are applicable".* We welcome this provision of the report, which acknowledges the principle that the secondary steel production route should be considered sustainable because it enables the recycling of steel, contributing this way to a significant reduction of CO_2 emissions, but at the same time we remark that the proposed threshold does not consider all the EAF produced steel qualities, in particular high alloy or stainless steels, nor all low carbon input material, eg. HBI/DRI, and would not correspond to a series of efficient practices in this production route. Thresholds for the use of steel scrap need to reflect technical feasibility, sufficient availability of needed scrap quality and the range of products being produced. In addition, expressing the threshold for the use of steel scrap in terms of iron content in the final product will be challenging and sometimes impossible to monitor.

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Therefore, we suggest using the share of scrap input as the indicator (as done in the June 2019 TEG report) and using the following thresholds for EAF produced steel qualities:

- ***Steel scrap input relative to product output for EAF carbon steel: >= 90 %***
- ***Steel scrap input relative to product output for EAF stainless and high alloy steel (speciality steels): >=70%***

Steel scrap is being recycled both in the primary and in the secondary production routes, contributing to circular economy, and reducing CO_2 emissions and energy use in all cases. Hence, best practice as regards steel scrap recycling should be supported in all instances for both production routes, whilst considering the share of alloys needed. It should be noted that, whilst stainless and other alloy steel (speciality steel) account for 21% of the steel produced in Europe by tonnage[10], their relative share in terms of economic value is more significant.

[10] European Steel in Figures 2020, page 17 (https://www.eurofer.eu/assets/Uploads/European-Steel-in-Figures-2020.pdf)

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aperam

Sustainability At the Heart of Aperam's Strategy

June 2022

BUSINESS OVERVIEW

Aperam is active in Stainless, Electrical & Specialty Steel & Scrap
#2 in Europe and the Only Producer in S. America

€5.1bn Sales*

~10,600 Employees

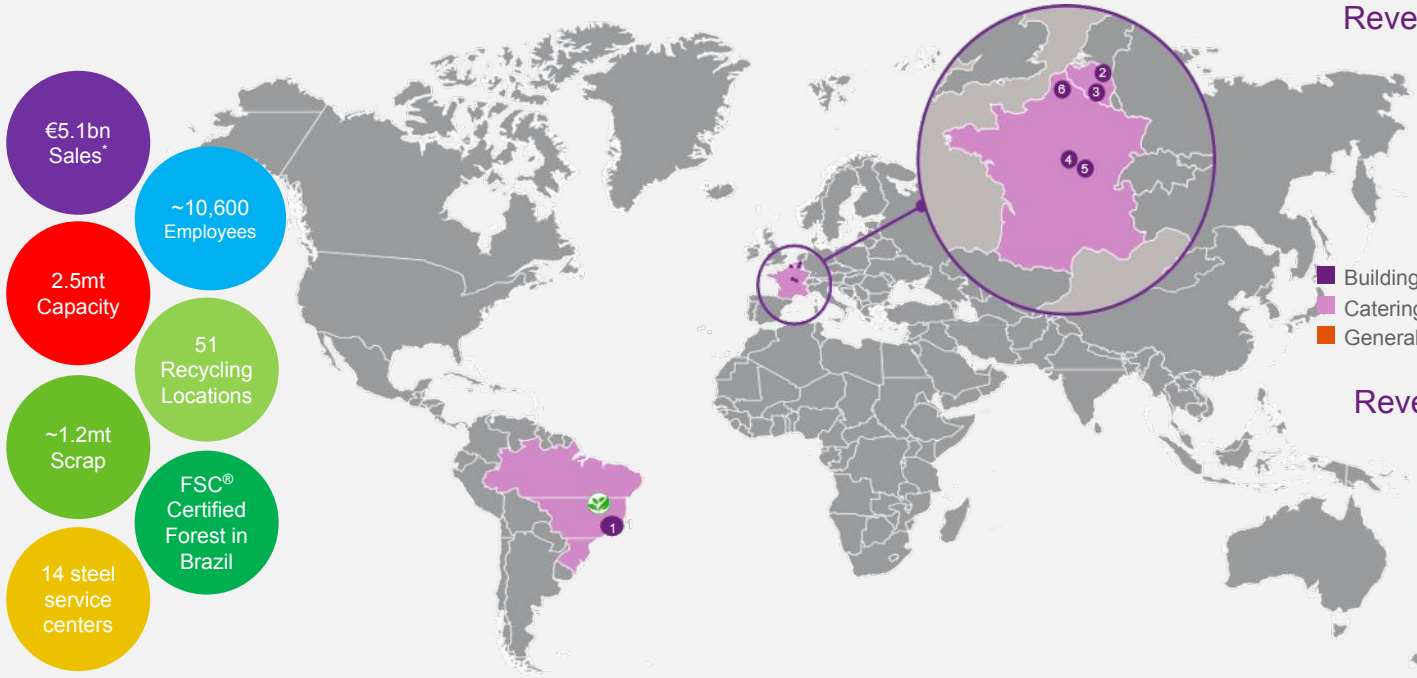
2.5mt Capacity

51 Recycling Locations

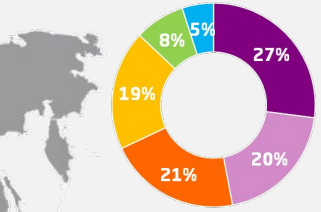
~1.2mt Scrap

FSC® Certified Forest in Brazil

14 steel service centers

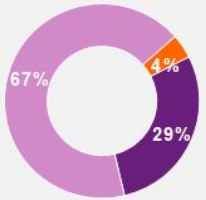


Revenue by industry 2021



- Building & Construction
- Automotive
- Catering & Appliances
- Energy & Chemicals
- General Industry
- Transport

Revenue by region 2021



- Americas
- Europe
- Asia

1 *Timóteo, Brazil* 2 *Genk, Belgium* 3 *Châtelet, Belgium* 4 *Imphy, France* 5 *Gueugnon, France* 6 *Isbergues, France* *BioEnergia, Brazil* *excl ELG

PRODUCT & PROCESS

Aperam Produces a Superior Product in a Sustainable and Responsible Way

SUPERIOR PRODUCT

- Very long useful life
- 100% recyclable
- Non toxic
- Corrosion resistant
- Acid resistant
- Fire proof
- Abrasion resistant
- Aesthetic
- Mechanically strong

RENEWABLE ENERGY

Our blast furnace in Brazil uses 100% charcoal as fuel –
produced from our sustainably cultivated FSC®-certified forests

RECYCLING

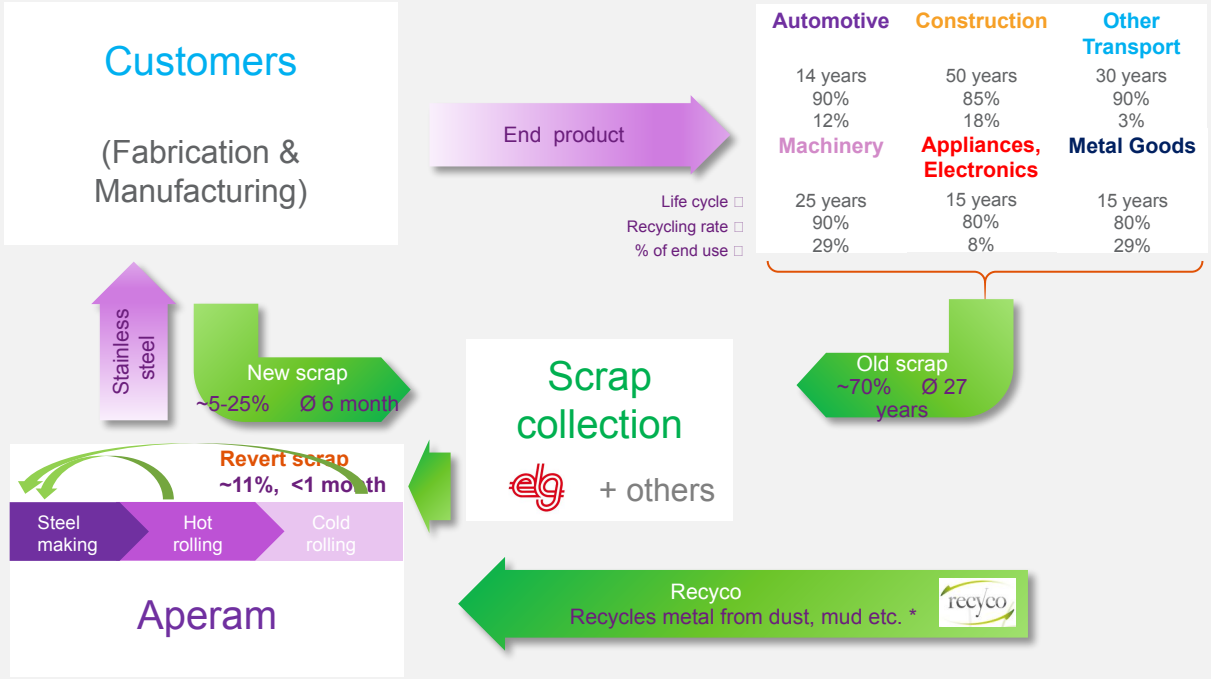
Aperam's main input in Europe is scrap & recycled materials (>80%)
Our Recyco unit recycles dust, sludges & residues for us and third parties

Best practice forest management, recognized by the Forest Stewardship Council's (FSC®) certification, which standards and principles conciliate ecological protection (flora and fauna, but also water reserves) with social benefits and economic feasibility. Our forests are made of selected cloned saplings which are considered among the best on the market and they are separated by firewalls and strips of natural vegetation to take into account both fire-prevention, biodiversity preservation and local development (beekeeping).

Renewable energy and recycling are key inputs in our production process

CIRCULAR ECONOMY

Aperam is at the Heart of the European Circular Economy.
Scrap & Recycled Material are our Dominating Input



- Aperam uses ~90% scrap in its austenitic grades
- Scrap is sourced regionally in Europe
- Aperam's location at the heart of Europe minimizes transportation costs & environmental impact

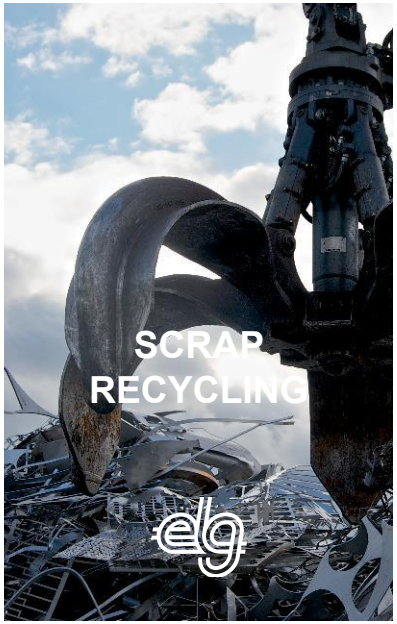
- Recyco recovers metal content from waste material*

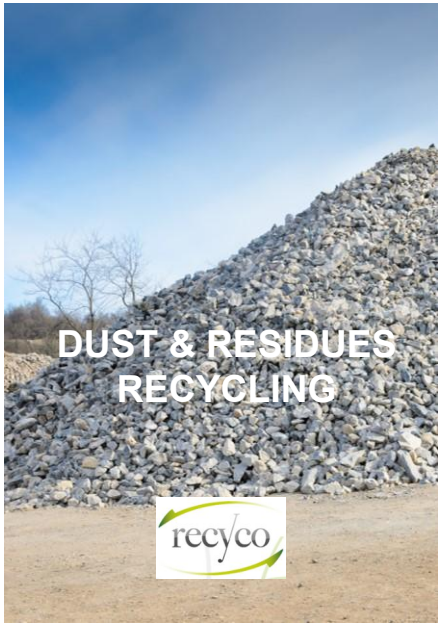
Source: Aperam, SMR, ISSF ** see 2020 Sustainability report p.35-37 for detail*

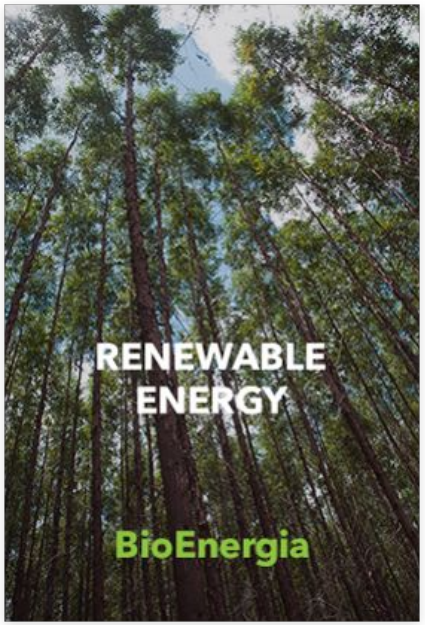
Scrap is a closed loop in Europe and our primary input in our European operations

RECYCLING & RENEWABLES

~30% of Aperam's Workforce Create Value from Working in Renewables and Recycling Upstream







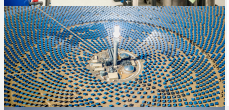
ESG Leadership

Stakeholder Value

Cost Benefit & Growth

PRODUCTS

We are Part of the Solution

	e-Mobility solutions	Aperam's solutions enable e-vehicle components such as converters, inverters, onboard-charges, motors, EPS, cooling systems, air conditioning systems, current sensors, charging stations, fuel cells and battery packs
	Clean air	Stainless and alloys help the marine transport sector minimizing emissions. Aperam offers scrubbing systems that remove over 90% of Sulphur and 80% of particles. Corrosion resistance grades with high mechanical properties are required
	Cryogenic applications	They require a material that can withstand very low temperatures. Aperam solutions (stainless and INVAR M93 LNG tanker) are specially designed for cryogenic storage; transporting natural gas, ethane, or ethylene; and handling liquefied air gases like nitrogen, oxygen and argon
	Sustainable water supply	Due to its inert nature, stainless is the material of choice for water supply (e.g. tanks and fountains, water boilers, sanitary piping systems, etc.) and water treatment (e.g. sewerage, distillation, desalination) applications
	**Solar power**	Alloys are resistant to heat, corrosion, fatigue, and creep. It is the ideal material for the receiver tubes used to ensure the flow of molten salt and for glass metal sealing. Stainless, is the material of choice for the structural and fixing elements used in solar power systems
	Renewable energy	Electrical steels enable high performing wind generators due to their high permeability. The magnetic properties of alloys convert and shape an electrical signal from generation to end use Anemometric towers built of stainless steel enjoy an increased life span, reduced maintenance costs, better safety
	The hydrogen economy	Stainless steel and alloys are already used in a number of important hydrogen applications eg fuel cells, production and storage installations, and transportation*. Aperam is a big supporter of the shift to hydrogen and a proud member of HydrogenEurope

**Eg electrodes in alkaline electrolyzers, catalysts for steam methane reforming, storage and transportation*

Stainless steel is a high added-value material that has a key role in the energy transition

UN SDG‘s

Aperam supports the United Nations’ Sustainable Development Goals, in Particular:

Health & Safety is Aperam’s primary concern and the priority in all our proceedings.

Gender balance ranks highly on our priority list with a special commitment from Management.
Aperam established specific objectives for creating more gender balance in our workforce.

Lowering water consumption and improving the quality of discharge are key elements of our environmental strategy.

Almost 50% of Aperam’s energy comes from renewables, mainly as biomass (charcoal) and increasingly also, wind and solar.

Research & Development and innovation are top priorities for Aperam. We also help our customers to adapt their own processes (welding, stamping, etc.) to make the most of their tools.

Aperam is committed to a sustainable cohabitation with our neighboring communities, allowing host cities to thrive and accommodating inhabitants’ legitimate requests.

Aperam is a recycling champion:
We use the maximum amount of recycled material in our production (eg +80% in Europe) and also recycle wastes and by-Products in line with our zero-waste target.

Our blast furnace uses charcoal, produced from our FSC® certified forest which also acts as a carbon sink. We have ambitious reduction targets to 2030 and target carbon neutrality by 2050.

Ethics are a key to Aperam’s values. We comply with all applicable regulations, interact transparently with authorities and support the fight against corruption or anti-competitive practices -among others.

Social *Environment* *Governance*

ESG

Aperam Approaches ESG Holistically

ENVIRONMENT

- Best-in-class CO_2e footprint[1]
- FSC®-certified forest provides renewable energy and certified CO_2e
- Clear improvement targets
  - Waste, aiming at zero-waste
  - Air (dust) emissions
  - Water consumption
  - Energy consumption
- Production is based on recycled materials, with plans to increase further
- Committed to net zero 2050 and SBTi-validated roadmap
- Superior product supporting the energy transition

SOCIAL

- Health & Safety is our prime objective
- Human Rights, Inclusion & diversity
- Training & development
- Positive social dialogue & responsible variabilization
- Quality of life at work and employee satisfaction

GOVERNANCE

- High ethical standards with zero-tolerance policy
- Responsible supply chain
- Majority of Board is independent
- Committees are exclusively independent
- Best-in-class ESG rating
- Active Foundation and stakeholder engagement
- ResponsibleSteel™ Certification roll-out in progress

(1) *scope 1+2*

ESG STATUS & TARGETS

A Best-in-Class Footprint & Clear Improvement Targets

We aim to become carbon neutral by 2050 & validate our CO_2 roadmap with the SBTi

CRITERIA	2030 TARGET	APERAM 2021	vs 2015	
Energy intensity[1]	6.9 GJ/tcs[2]	-11% vs 2015	7.8* GJ/tcs[2]	0%	!
CO_2 intensity[3]	0.30 te/tcs[2]	New objective	0.33* te/tcs[2]	-39%	✓
Water consumption	6.1 m^3 /tcs[2]	-40% vs 2015	10.0* m^3/tcs[2]	-2%	!
Dust intensity	76 g/tcs[2]	-70% vs 2015	155* g/tcs[2]	-38%	✓
Zero waste target	>97% reused / recycled		92.9%	-0.6pp	!
Health & Safety	TRIR<3 in 2026		7 (new indicator)		!
Diversity	30% of exempts in 2029		Women 13.5% of staff 7.4% blue collar, 22.4% of exempts		
Digital Learning	30% of total learning hours in 2029		18%		
Employee Satisfaction	>80% of Sustainable Engagement		80%		

(1) only electricity, LPG and natural gas, (2) per ton of slab (internal/external), (3) Scope 1+2, including yearly removals for our forestry. (4) Using comparable methodologies, our 2021 CO2e intensity decreased by 2%, but the 0.33t/tcs includes methodological updates rendering the comparison with 2020 irrelevant. ** Data having received external assurance*

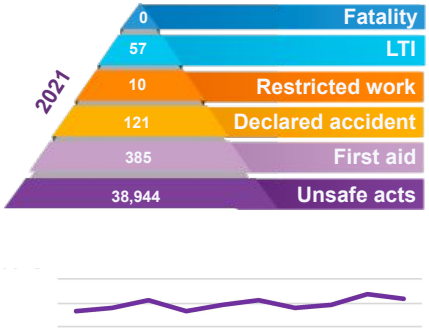
We aim to exceed legislation and are committed to continuous improvement

HEALTH & SAFETY

Our Prime Objective

LTIFR IS HALF OF SS INDUSTRY* …

… WITH VERY LOW SEVERITY RATE**



ROADMAPS WITH 3 STRATEGIC AXES

- **Prevent and control the risk of fatal and severe accidents**
  - Detailed improvement plan post a H&S audit of each site
  - Monthly monitoring

- **Identify cultural maturity**
  Uses external framework to assess and improve H&S at each site individually

- **Support and coordinate transversal actions**
  Launch of single incident reporting and investigation tool

* Lost time injury frequency rate = number of injuries resulting in lost time per million working hours – 2020: Aperam 1.5 versus ISSF average 3.1, ISSF 2021 data will be published in late May 2022

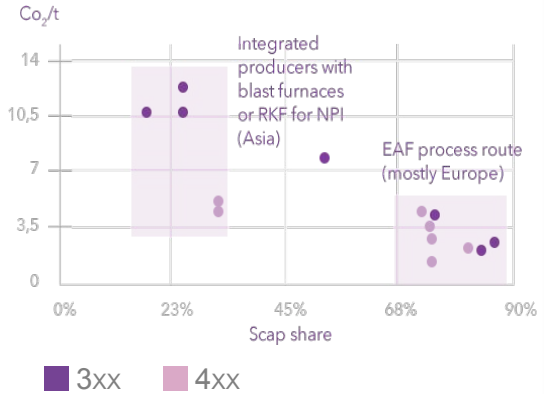
** Severity rate = total number of days lost for accidents/total/hours worked x 1,000,000.

H&S Performance is reflected in Management Compensation

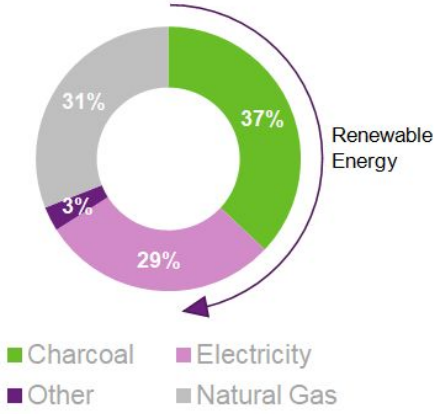
GHG

Recycling Content & Renewable Share puts Aperam in a Best-in-Class Position

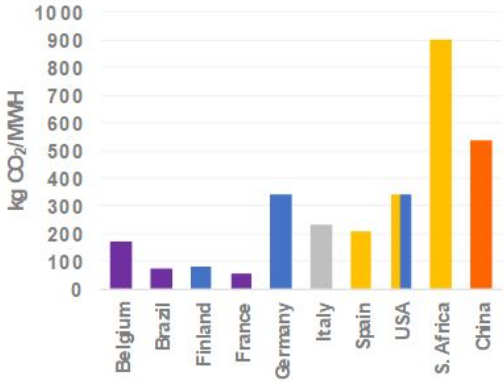
SCRAP USAGE REDUCES CO_2 EMISSIONS SUBSTANTIALLY*



APERAM ENERGY MIX 2021



ELECTRICITY IS KEY FOR DECARBONIZING



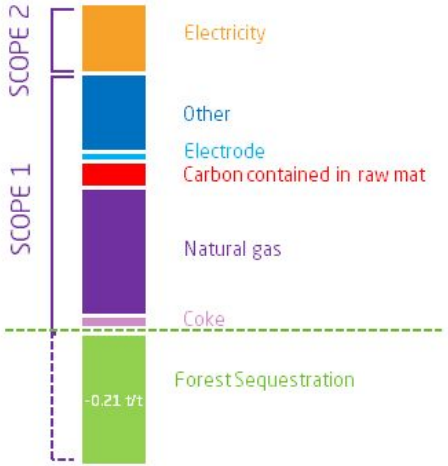
*Source: Company data, Aperam **estimates**, EEA, IEA*

**scope 1 + 2 + 3a incl . raw material*

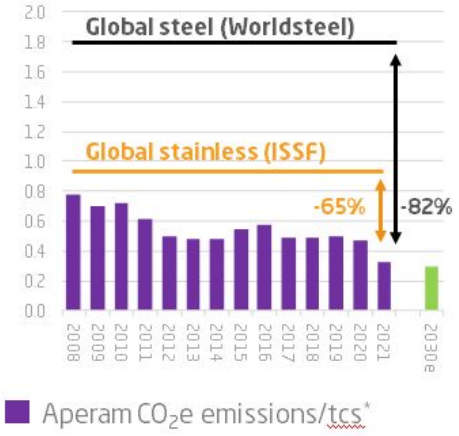
GHG

Aperam has a Transparent & Realistic Plan for Realizing 0.30 tCO_2e/tcs by 2030 and Carbon Neutrality by 2050

APERAM CO_2 EMISSION BY SCOPE 0.33te/tcs*



APERAM CO_2 EMISSIONS ROADMAP*



MEASURES & CAPEX

Target: <0.3 tCO_2e/tcs in 2030*²

- ~33% are based on energy efficiency projects and heat recuperation
- ~33% are based on the decarbonization of energy
- ~33% gains in direct CH_4 emissions
- Capex for 2030 targets ~EUR20m pa**
- FSC® certified forest operations play a key role for reaching net zero by 2050

*Scope 1 (non-biogenic) + scope 2 (market-based) ; for change in methodology please refer to Aperam's 2021 ESG report

* Mainly covered by normal annual maintenance & growth capex budget. 2020-30 total spend ~EUR200m

²versus 2015 (0.54 tCO_2e/tcs)

We are covered with ETS Certificates till ~2030 and our plan is Capex Light

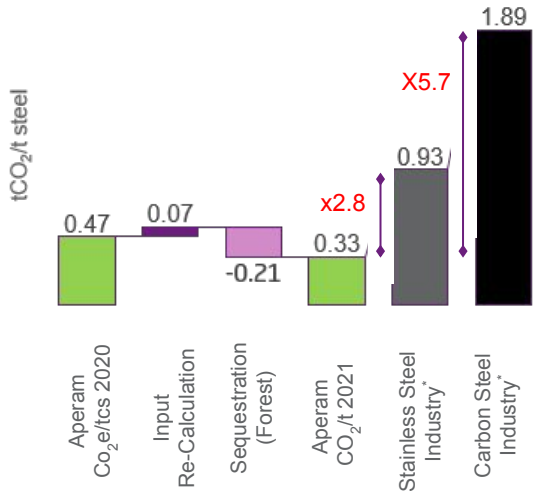
Q1 2022 ESG HIGHLIGHT

Forestry is a Valuable Decarbonisation Asset With Substantial Growth Potential to 2050

BIOENERGIA INCLUDED IN NEW RECYCLING & RENEWABLES SEGMENT

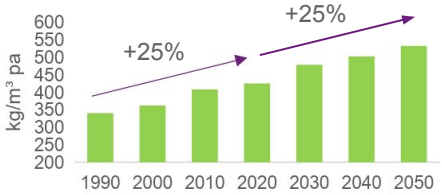
- Since Jan 2022 BioEnergia is reported in the newly formed Recycling & Renewables segment (used to be part of S&E Brazil before)
- BioEnergia owns ~130,000 ha Land in Minas Gerais (Brazil)
- 40,000 ha preservation area that is wildlife habitat
- Capex of EUR15-20m pa, employs ~1000 people

APERAM OWNS A BEST IN CLASS CARBON FOOTPRINT[2]



BIOENERGIA GROWTH PLAN SUPPORTS CARBON NEUTRALITY BY 2050

- Continue to increase forestry asset density (optimized plants & operations)

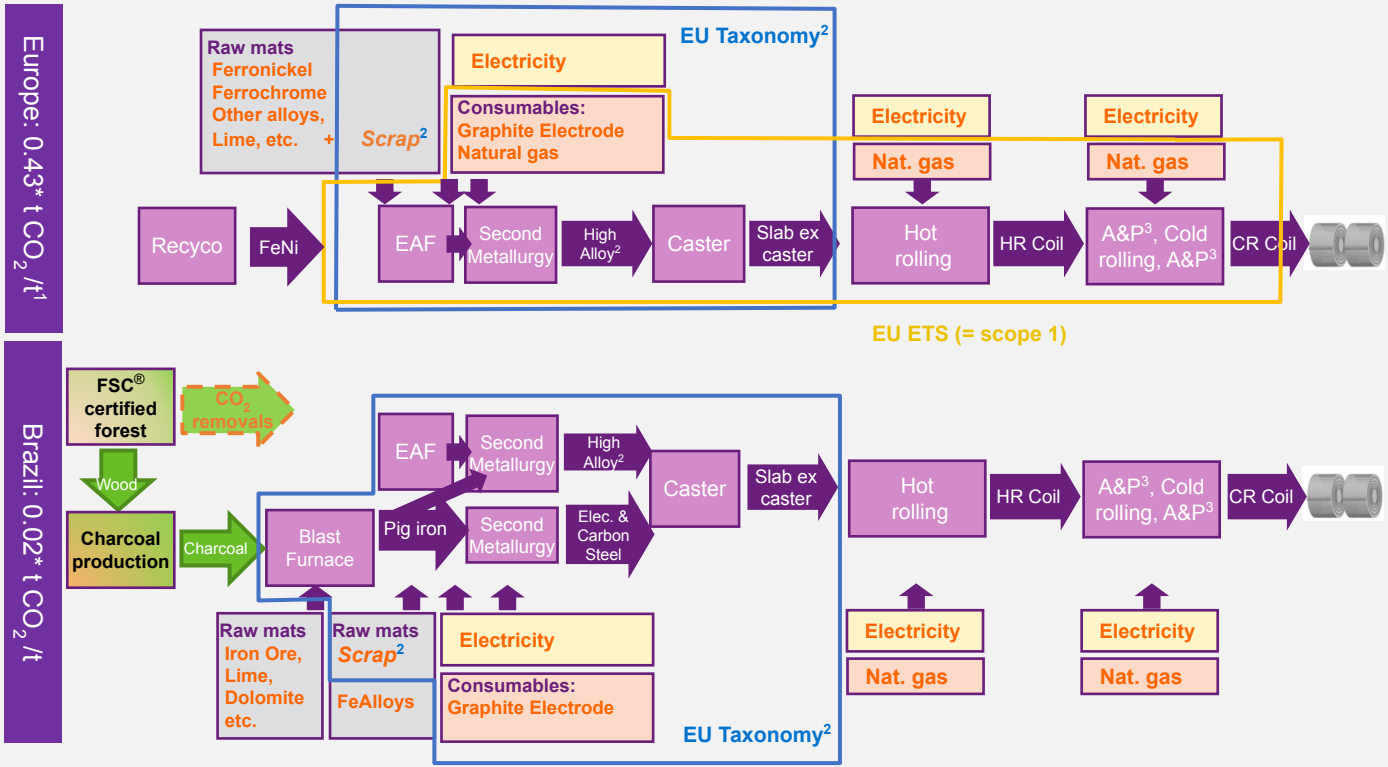


- Acquire rights for an additional 26k ha
  - Additional biomass capacity
  - Value accretive with IRR >15%

** most recent available data from ISSF , Worldsteel , [2]change in methodology was externally verified based on ISO 14064*

ENVIRONMENT

Aperam has an industry leading CO_2e footprint[1] and clear improvement targets for 2030



Scope 1 – All Direct Emissions from the activities of an organisation or under their control (can be either biogenic i.e from biomass, or non-biogenic).
Scope 2 – Indirect Emissions from electricity purchased and used by the organisation.
Scope 3 – All Other Indirect Emissions from activities of the organisation, occurring from sources that they do not own or control (3a: Upstream, ie mostly Raw materials)
(1) per tonne of slab, scope 1 + 2 (Scope 1 non-biogenic, Scope 2 "market-based") based on ISO14404 (incl. purchased tons processed internally and hire-work)
(2) EU Taxonomy* requires:
- for high alloy steel (stainless): 0.266 (mitigation) to 0.360 (adaptation) tCO_2e/tcs ex-caster Scope 1 for EAF route or a 70% scrap ratio minimum.
- for carbon steel: 1,331 (mitigation) to 1.443 (adaptation) tCO_2e/tcs ex-caster Scope 1 for hot metal i.e BF route), or a scrap ratio at 90% minimum.
(3) Annealing & Pickling.

* Data having received external assurance

GOVERNANCE & STAKEHOLDERS

"We lead by example and maintain constant engagement with all our Stakeholders in quest for mutually beneficial solutions"

- **Best practice in Corporate Governance** reflected in our:
  - Committee composition
  - Risk management approach
  - Extensive Compliance plan
- **Responsible Purchasing** policy and procedures
- **CSR indicators** cascaded within the entire organisation
- **Community** engagement
- Leadership/Excellence level **ESG ratings**
  (refer to last page)
- Strong **Customer and innovation** focus

Indicator	Unit	2021	2020	2019	2018
Customer Satisfaction: Alloys	Rate on 10	9.2	n/a	8.8	n/a
Customer Satisfaction: Stainless		7.9(2)	8,0(2)	n/a	7.6(2)

(1): Europe , (2): Brazil

GOVERNANCE & STAKEHOLDERS

ResponsibleSteel™ as part of our strategic plan making corporate responsibility more widely recognised

ResponsibleSteel™ helps steel producers answer the sustainability concerns of their customers while addressing the expectations of the Civil Society. It is a member-based not-for-profit organisation.
Using an independent certification standard, the initiative enables to promote steel as the responsible material of choice.

- Aperam actively participates in the development of the ResponsibleSteel™ standards (site-level and product).
- In 2021, Aperam was **the first Stainless producer to earn the Site-level certification** for its Stainless Europe perimeter.

Benefiting everybody

- External certification is much more satisfactory for **customers and end-users** than a pure document-based approach.
- **Local communities and employees** will benefit too from the high sustainability standards and transparency this initiative sets taking into account the ideas shared by members that represent their interest.
- As for **Suppliers**, ResponsibleSteel™ cooperates with existing Mining standards to assess if we can integrate their own specific grade to rate the suppliers, recognizing the efforts of the best operators.

> *"The ResponsibleSteel™ label will play a prominent role in making the steel industry a true ally in building the sustainable and responsible society we strive to live in."*
>
> **Tim di Maulo**,
> Aperam CEO

The Site-specific standard consists of 12 principles for the responsible sourcing and production of steel

GOVERNANCE & STAKEHOLDERS

Communities & Corporate Citizenship

Maintaining a close relationship with our stakeholders is consistent with our values and also sound business management.

In Brazil, the Aperam Acesita Foundation is à private, non-profit institution. Its mission is to promote the integrated and sustainable development of communities where Aperam South America maintains its main activities.

The foundation concentrates on 4 key areas:

- > Education
- > Culture
- > Environment
- > Social promotion

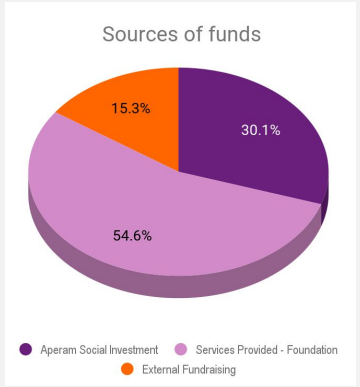
Stakeholder Engagement, the Aperam Way

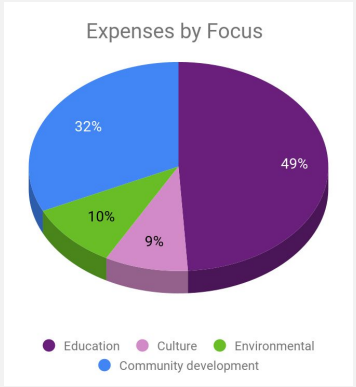
- ✔ Official Stakeholder Engagement policy
- ✔ Group Sustainability report in English
- ✔ Country supplements in local languages
- ✔ Entrance Posters and site-specific web pages with key Social & Environmental indicators
- ✔ Ongoing Environmental monitoring
- ✔ Stakeholder dialogue directly by sites or via our Acesita Foundation
- ✔ Development program via our Foundation
- ✔ 24h/7 Online contact form in local languages
- ✔ Company-wide Impact Assessment (2016)
- ✔ Human Rights/Discrimination risk method
- ✔ Biodiversity risk assessments in progress

Aperam Acesita Foundation Activity GRI 413-1

Indicator	Unit	2021	2020	2019	2018
Beneficiaries	#	> 26,000	> 40,000	>65,000	>64,000
Cultural Events		60	94	89	102
Online Events - Views		> 61,000	>265,000	n/a	n/a
Social Impact Investments (Social Projects only)	BR$ million	2.7	1.9	2.3	2.9
Other Aperam Acesita Foundation Expenses		1.1	0.8	0.9	n/a
Total Investments by the Foundation(1)		**3.7**	2.7	**3.2**	**2.9**

(1) Including expenses linked to the services provided.





GOVERNANCE & STAKEHOLDERS

Ethics and Compliance

- **Very strong ethical guidelines** based on Aperam values that go much beyond regulatory required compliance
- **Zero tolerance for non-compliant behaviour**
- **Full ethical framework** based on regular Communications, Training, Expertise and Continuous improvment with yearly routines (Conflict of interest declarations)
- Beyond regulations, high focus on **best practices**

Aperam policies inspired by international references:

- International Labour Office
- UN Human Rights charter
- UN Global Compact
- UN convention Against Corruption
- OECD Guidelines for Multinationals
- ISO standards: Quality, Energy, etc.
- SA 8000

2021 key facts

Key actions:

- New self-guided training on our Code of Conduct consisting of a short video with real-life examples.
- 3nd Company wide anti-fraud week and specific event on Human Rights Inclusion & Diversity.
- Best-in-class process with automated Compliance routines hosted on the People Management IS.

Investigations:

- 13 allegations relating to fraud referred to the Group's Internal Audit for investigation.
- At end 2021: 4 forensic cases and 10 ethical cases, with investigations finalized (0 significant cases).
- Review by Audit and Risk Management Committee & report to Board of Directors.

Zero tolerance policy for non compliant behavior

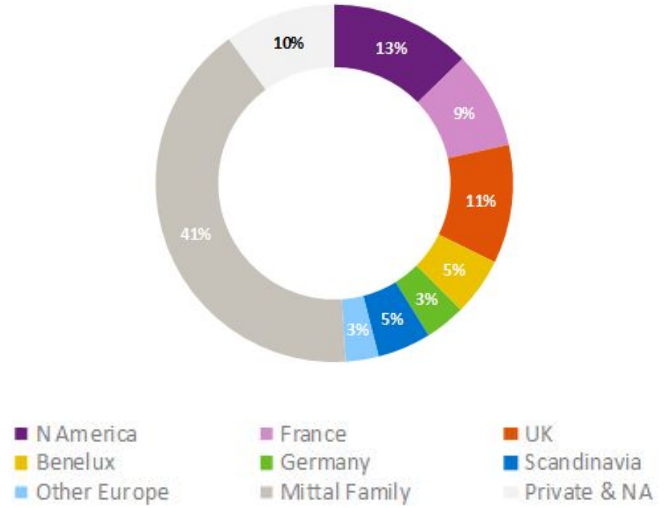
GOVERNANCE

Our Diverse Board of Directors Ensures Effective Governance

PRINCIPLES OF BOARD

- Responsible for strategic direction and oversight of the business, as well as for appointing senior management
- Election subject to shareholder approval. Directors are elected for 3 year terms
- Chairman: Mr. Lakshmi N. Mittal
- 7 members with a majority of independent directors (4 independent directors out of 7)
- Mrs. Ros Rivaz is lead independent director
- 2 Board Committees composed of 100% of independent directors and reporting to the Board of Directors:
  - Audit and Risk Management Committee covering also ESG matters ; Chair: Ms. Bernadette Baudier
  - Remuneration, Nomination and Corporate Governance Committee ; Chair: Mr. Alain Kinsch

SHAREHOLDER STRUCTURE



GOVERNANCE

Our Leadership Team: Diverse & Experienced

KEY FACTS & COMPENSATION

- Entrusted with day-to-day management of the Company
- Appointed by the Board of Directors
- Experience and industry know how
- Average age: 50 / 6 nationalities
- CEO: responsible for Aperam's sustainability performance and compliance
- CTO is also Head of Health, Safety & Environment
- Compensation aligned with long term interest of the Company and its stakeholders
  - Multiplier for performance related bonus includes H&S factors (1 year plan)
  - Long term incentive plans based on ESG targets, EPS, TSR evolution (3 year plan) vs relevant peers and index

** & sustainability*

Aperam benefits from the experience and industry know-how of its Leadership Team

RECOGNITIONS

Our Commitment to Sustainability is Recognised by Investors, NGOs, and Certification Authorities

Investor Perspective

MSCI

Reconfirmed as "AA" (Leadership level) by MSCI

included in ETHIBEL SUSTAINABILITY INDEX EXCELLENCE Europe

Listed in Excellence registers

Gaïa RATING

Rated 78/100 pts by EthiFinance

CDP DRIVING SUSTAINABLE ECONOMIES

Rated "B" (Management level) by CDP

ISS

SUSTAINALYTICS a Morningstar company ESG INDUSTRY TOP RATED 2021

Customer Perspective

GOLD 2022 ecovadis Sustainability Rating

Ecovadis
Rated Gold

Employee Perspective

PALMARÈS Capital MEILLEUR EMPLOYEUR 2021

LUGARES INCRÍVEIS PARA TRABALHAR 2021

Best employer #10 in France in the Heavy industry and Material sector (Capital)

Q&A

Please send your Questions to
sustainability@aperam.com

Lower feedstock prices needed in Europe: Outokumpu

argusmedia.com/en/news/1858808-lower-feedstock-prices-needed-in-europe-outokumpu

4 March 2019

1. Home
2. News
3. News article

Published date: 04 March 2019

Europe's largest stainless steel producer Outokumpu is calling for lower feedstock prices amid intense competition from Asian mills.

"This is a message to our suppliers that we need better discounts [in stainless steel scrap and ferro-nickel] to compete with our Asian competitors," Finnish firm Outokumpu market intelligence manager Antti Saarela told delegates at the Argus NiCoMo conference in London last week.

Unlike Chinese and Indonesian stainless steelmakers, producers in Europe rely mostly on 304 series stainless steel scrap (containing 8pc nickel content), followed by ferro-nickel as the main feedstock. European mills then use refined nickel to ensure the level of nickel content is met in different alloys.

According to market participants, stainless steel scrap accounted for up to 80pc of European stainless steelmakers' feedstock.

Outokumpu said that the prices of stainless steel scrap and ferro-nickel in Europe are too high when compared with nickel pig iron (NPI), which is the main feedstock for Asian stainless steel mills.

According to Outokumpu, NPI was priced at 50pc of the LME nickel contract in September 2017. The discount to the LME price had widened to 60pc in June 2017 before narrowing to close to 40pc at the end of 2018. NPI's discount to the LME nickel price was at around 45pc in January.

Meanwhile, the discounts to LME nickel prices on 304 series stainless steel scrap in Europe was at 30pc in January and ferro-nickel prices are just a few percent below the LME contract.

Stainless steel scrap discounts to LME nickel prices started to widen in July 2016, Outokumpu data show.

Discounts are reported to have been as wide as 35pc in some parts of Europe since late 2018 and traders said this was the widest for some years.

Argus 304 stainless steel scrap prices were last assessed at €1,030-1,060/t on a cif Rotterdam basis on 28 February.

In addition to low NPI prices, "there is also unfair state subsidy that is supporting the Chinese stainless steel industry. Unlike Europe, companies in Asia don't have to pay for their carbon emission," Saarela said.

Integrated Chinese-owned stainless steelmaker Tsingshan Holding Group set up a 3mn t/year mill in Indonesia and production started in 2017. Tsingshan Indonesia also operates its NPI and chrome mining, which enables the steelmaker to benefit from low-cost production.

Outokumpu's global shipments reached 2.43mn t in 2018, down by 0.8c from 2.45mn t in 2017.

Related News

02 November 2023

Tata Steel could idle UK hot-rolling mill

Tata Steel's announcement that was pulled at the last minute involved the idling of its hot strip mill in the coming months as well as its blast furnaces. The idling of the strip mill would leave Tata as an importer of hot-rolled coil (HRC), possibly from its Indian parent, that would be further pr

01 November 2023

ArcelorMittal obtains freezing order against Liberty

ArcelorMittal has secured freezing orders against Liberty Steel companies as it seeks payment of an outstanding €140mn arbitration award. On 19 September, the High Court of Singapore granted ArcelorMittal a freezing injunction against Liberty that prohibits the transfer of Liberty's Singaporean ass

31 October 2023

Liberty Steel looking to sell iron ore from Romania

Liberty Steel is looking to resell iron ore from Constanta port in Romania originally destined for its Galati blast furnace. The company recently idled its only operational blast furnace in Romania, citing inclement weather in the Black Sea and low water levels on the Danube as reasons for the stop

31 October 2023

Interlink to build titanium plant in Bahrain

Switzerland-based titanium supplier Interlink Metals and Chemicals plans to build a titanium production facility in Bahrain, which is scheduled to be operational by mid-2025. The fully integrated production facility will operate an electron-beam (EB) and a vacuum-arc (VAR) furnace, for the producti

View all articles

Uncertain future for Europe’s scrap market: Cronimet

argusmedia.com/en/news/2376111-uncertain-future-for-europes-scrap-market-cronimet

30 September 2022

Published date: 30 September 2022

The European stainless steel scrap market is facing a near-term demand crisis and high uncertainty going into the fourth quarter, according to Jurgen Pilarsky, chief executive at scrap processor and metals trading group Cronimet.

"The market is collapsing at the moment," Pilarsky said. "There is always a summer lull, but what we have recently is 2-3 months of no demand at all." Speaking to *Argus* on the sidelines of the International Stainless and Special Steel Conference in Hamburg, Germany last week, Pilarsky said the slowdown has been driven by steelmakers holding greater inventory of finished stainless steel as their order books have thinned from the prevailing macro environment of high inflation, with the consequent cuts to new production hitting scrap demand and making it difficult for scrap suppliers to forecast future demand accurately.

"If our customer needs material in November, we have to purchase and process scrap just now," he said. "But we have no clue if there is a need and almost need some guidance from our customers."

Since 5 May this year, the *Argus* assessment for stainless scrap 304 (18-8) stainless steel scrap solids cif Rotterdam has more than halved to €1,125-1,150/t on 29 September, with the corresponding assessment for molybdenum-bearing 316 cif Rotterdam falling by 42pc to an average of €1,900-1,950/t.

In an oversupplied European market, which has further been hit by increased imports of finished stainless steel from Asia, Pilarsky indicated that demand is likely to remain weak and visibility on market direction poor through to the end of 2022.

"There is no idea in the whole value chain about what will happen in the next 3-4 months," he said.

According to Pilarsky, steelmaker activity in Europe is mixed and is governed by energy prices, with mills located in regions that have lower relative costs at an advantage over others. But the overwhelming majority are waiting for the inflationary pressures on operations to ease, particularly through improved supply and government intervention, so underlying demand can return and production can be ramped up once again.

Governments of Nordic countries, including Finland which is home to major stainless steel producer Outokumpu, have recently urged the European Commission to take further steps to reduce power consumption and to mitigate increasing power prices driven by

rising gas costs. And a consortium of 15 EU ministers, including from Spain and Italy, have recently resignalled the need for the commission to present a proposal for a wholesale gas price cap to ensure security of supply and the free flow of gas within Europe. But the market is still mostly waiting for a breakthrough that would boost near-term demand for stainless steel producers, and consequently for scrap suppliers.

Low demand in Europe has led to more stainless steel scrap flowing to major export markets such as India. And Pilarsky said lower container prices from Europe to Asia are also a major contributing factor to the rise in scrap exports to Asian destinations.

"In the past, we had low container availability and high costs," Pilarsky said. "But freight rates to Asia have been getting lower over the past few weeks."

The outlook for Asian demand remains robust, Pilarsky said, with the lower CO2 footprint of stainless steel scrap making it the first choice for producers seeking to meet sustainability standards. But he cautioned that overseas demand could fall if seaborne scrap prices rise too high, as that would prompt buyers to seek out alternative products.

"Scrap always finds a customer, there is always more demand than availability," he said. "Eventually the market levels up because the price increases to a point where it becomes cheaper to produce using nickel pig iron and ferronickel."

Some sections of the market have pointed to greater scrap utilisation by stainless steelmakers as an avenue for near-term demand. Scrap ratios adopted in stainless steel production are mixed, with some producers in Europe operating at very high levels of scrap utilisation — 90pc and above in some cases — with others using less. But according to Pilarsky, scrap demand is largely not related to ratios as there is only a 1-3pc room for stainless steel producers in Europe to increase utilisation.

"Demand is tied to increasing and decreasing production only," he said. "We have seen that in the past when scrap ratios have moved higher."

By Raghav Jain

MB STAINLESS HELSINKI: Ferro-nickel 'losing competitiveness' against stainless scrap, NPI

fastmarkets.com/insights/mb-stainless-helsinki-ferro-nickel-losing-competitiveness-against-stainless-scrap-npi

September 20, 2018

Ferro-nickel has lost competitiveness against stainless steel scrap and nickel pig iron (NPI) as a raw material input for stainless steel, according to Frank Ehrenberg, senior vp for raw materials procurement at Finnish steelmaker Outokumpu.

September 20, 2018

By Generic people page
At the Metal Bulletin and Steel & Metals Market Research (SMR) stainless steel conference in Helsinki, Finland, on Wednesday September 19, Ehrenberg said that Chinese stainless mills were now using less imported ferro-nickel due to plentiful supplies of local NPI.

"Ferro-nickel is starting to be discounted due to this trend," Ehrenberg said, adding that the move away from ferro-nickel was not just confined to China and the change was likely to be a worldwide trend.

Metal Bulletin price assessment for ferro-nickel premiums, cif China, was rangebound between a discount of $200 per tonne and $300 per tonne on August 28, down from a premium of $200-350 per tonne two months earlier on June 25.

Metal Bulletin's price assessment for 10-15% nickel content China high-grade NPI spot material was 1,060-1,080 yuan ($155-158) per nickel unit on September 18, down from a recent high of 1,120-1,140 yuan per nickel unit on September 4.

Ehrenberg said European mills were also using less ferro-nickel "due to the good availability of stainless steel scrap at high discounts."

Earlier this month a trader told Metal Bulletin that nickel discounts were at record levels.

"We have a historically wide nickel discount [for nickel units in the scrap relative to the LME price] with the mills," the trader said.

Metal Bulletin's weekly price assessment for 18/8 stainless steel solids imported into mainland Europe was €1,050-1,100 ($1,226-1,285) per tonne cif main European ports on Friday September 14, down from €1,120-1,150 per tonne two weeks earlier, following

heavy nickel losses on the LME.

Stainless scrap discounts should also widen to allow European mills to remain competitive against Asian competitors using cheap Indonesian-origin nickel pig iron, Ehrenberg said.

And European and US mills should increase scrap usage in their raw materials mix to compete against NPI-based stainless steel production in Asia, he added.

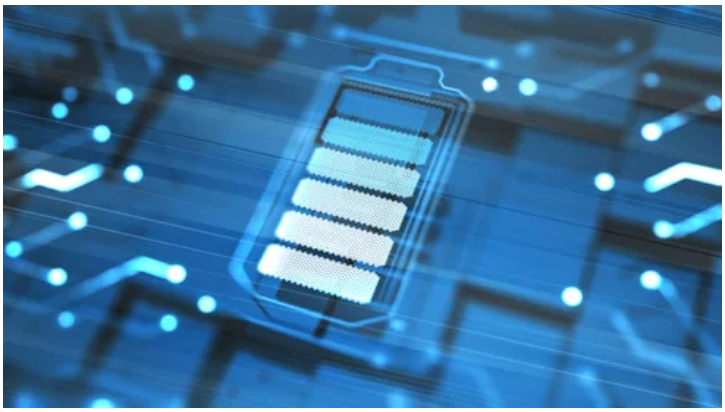
He said Outokumpu had successfully experimented with a raw materials charge mix containing 95% stainless steel scrap to make grade-304 stainless steel – up from the usual 85%.

However, for other grades, such as type-316 stainless steel, where scrap availability is lower, ferro-nickel will still be required, Ehrenberg said.

Despite high transport costs from Asia, NPI does not pose technical issues and could also be used as an alternative input for European and US mills, according to Outokumpu.

However, Gerhard Pariser, head of market research at stainless scrap recycler ELG Haniel, told conference attendees that the use of stainless scrap as a raw material instead of NPI or ferro-nickel "significantly lowers stainless steel's carbon footprint."

What to read next



Global lithium prices continue to tumble on sluggish demand

China's lithium prices extended losses in the week ended Thursday November 2, which market participants attributed to ongoing weak demand and bearish sentiment.

November 3, 2023

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By the Fastmarkets team

Stainless steel scrap deviates from nickel price rally

argusmedia.com/zh/news/2002968-stainless-steel-scrap-deviates-from-nickel-price-rally

Published date: 25 十月 2019

Cut-throat competition from cheaper Asian imports has forced European stainless steel producers to seek record discounts for scrap feedstock, causing the market to deviate from the nickel price rally.

"There is a de-coupling of the stainless steel and nickel market," one processor said at the sidelines of the BIR conference in Budapest, Hungary last week.

The three-month nickel contract traded on the London Metal Exchange (LME) rallied in July after the Indonesian government first discussed bringing forward its planned nickel ore ban by two years from 2022. The policy was confirmed in September and Indonesia will stop exporting low-grade nickel ore from 1 January 2020.

Following the announcement of the ban, the LME three-month nickel price rocketed to a five-year high at $18,475/t on 2 September, up 52pc from $12,120/t on 2 July. Prices have since corrected downwards to $16,885/t on 25 October but continued to hover at around four-year highs.

Prices for 304 stainless steel scrap solids did move up throughout July and August in response to the nickel rise, with the *Argus* weekly 304 scrap solids cif Rotterdam price rising from €980-1,050/t on 4 July to €1,100-1,150/t on 12 September.

But the pace of the increase lagged the meteoric nickel increase. The average *Argus* weekly price assessment of 304 stainless steel scrap solid over the 4 July-5 September period was €1,076.25/t ($1193.29/t), compared to an average LME nickel price of $15,000/t over the same time.

Since mid-September, the 304 price has actually fallen back to its early-July level. The *Argus* stainless scrap solids 304 (18-8) cif Rotterdam price was assessed at €950-1,000/t on 24 October, equivalent to 47.9-50.5¢/lb.

The 304 stainless steel series typically contains 8pc nickel and 18pc chrome. The price formula of stainless steel scrap consists of nickel payables — calculated based on a discount to the LME nickel contract — and chrome prices. The nickel payables are negotiated between the stainless steel mills and blenders every month in Europe.

In Europe, the average nickel payables for 304 stainless steel scrap solid for delivery to mills in October settled at 63pc (equivalent to 37pc discounts to LME nickel contract). This is 5-10 percentage points lower than the average payables of 68-73pc in May-September.

For November, payables were concluded as low as 55pc in some deals.

Nickel payables are normally around 95pc but the discounts have widened significantly since mid-2018 as mills negotiated successfully for lower payables. Mills have argued for cheaper feedstock prices because of poor demand for stainless steel products as a result of an influx of cheap imports from China and Indonesia.

"Historically, payables are just below 95pc of LME nickel, at 95pc it's already bad," said one nickel trader.

When the discount was at 30-32pc in the third quarter, one processor commented that "the discount has never been this big", yet the payables continued to breach new lows, which has hurt processors' profit margins.

"The problem is [the payables] decreasing so fast in such a short period of time. If it's stable, we can keep our margin," a second processor said.

Stainless steel mills calls for lower feedstock prices

Stainless steel mills such as Finland-based producer Outokumpu has openly called for lower feedstock prices in order to compete with cheap imports from Asia.

Unlike Chinese and Indonesian stainless steelmakers, European producers rely mostly on the 304 series stainless steel scrap, followed by ferro-nickel as the main feedstock. European mills then use refined nickel to ensure the nickel content is met in different alloys.

According to market participants, stainless steel scrap accounts for up to 80pc of European stainless steelmakers' feedstock.

Integrated Chinese-owned stainless steelmaker Tsingshan Holding Group set up a 3mn t/year mill in Indonesia and production started in 2017. Tsingshan Indonesia also operates its NPI and chrome mining, which enables the steelmaker to benefit from low-cost production.

Section XV

BASE METALS AND ARTICLES OF BASE METAL

CHAPTER 72

Iron and steel

Definition

For the purposes of this Chapter, the expressions "cold-rolled (cold-reduced)" and "cold-formed" mean cold reduction resulting in changes to the crystalline structure of the workpiece. The expressions do not include very light cold-rolling and cold-forming processes (skin pass or pinch pass) which act only on the surface of the material and do not result in change to its crystalline structure.

Chapter Note

For the purposes of this Chapter, a change of classification resulting only from cutting is not to be considered as origin-conferring.

Chapter residual rule:

Where the country of origin cannot be determined by application of the primary rules, the country of origin of the goods shall be the country in which the major portion of the materials originated, as determined on the basis of the value of the materials.

HS 2022 Code	Description of goods	Primary rules
7201	**Pig iron and spiegeleisen in pigs, blocks or other primary forms.**	CTH
7202	**Ferro-alloys.**	CTH
7203	**Ferrous products obtained by direct reduction of iron ore and other spongy ferrous products, in lumps, pellets or similar forms; iron having a minimum purity by weight of 99.94 %, in lumps, pellets or similar forms.**	CTH
7204	**Ferrous waste and scrap; re-melting scrap ingots of iron or steel.**	***As specified for split headings***
ex7204(a)	- Ferrous waste and scrap	The origin of the goods of this split heading shall be the country where they were derived from manufacturing or processing operations or from consumption

HS 2022 Code	Description of goods	Primary rules
ex7204(b)	- Re-melting scrap ingots of iron or steel	The origin of the goods of this split heading shall be the country where the waste and scrap used to obtain them were derived from manufacturing or processing operations or from consumption
7205	**Granules and powders, of pig iron, spiegeleisen, iron or steel.**	***As specified for subheadings***
7205 10	- Granules - Powders:	CTH
7205 21	-- Of alloy steel	***As specified for split subheadings***
ex7205 21(a)	--- Mixed powders of alloy steel	CTSH or CTSHS provided recasting or atomizing of the cast alloy
ex7205 21(b)	--- Unmixed powders of alloy steel	CTSH
7205 29	-- Other	***As specified for split subheadings***
ex7205 29(a)	--- Other mixed powders	CTSH or CTSHS provided recasting or atomizing of the cast alloy
ex7205 29(b)	--- Other unmixed powders	CTSH
7206	**Iron and non-alloy steel in ingots or other primary forms (excluding iron of heading 7203).**	CTH
7207	**Semi-finished products of iron or non-alloy steel.**	CTH, except from heading 7206
7208	**Flat-rolled products of iron or non-alloy steel, of a width of 600 mm or more, hot-rolled, not clad, plated or coated.**	CTH
7209	**Flat-rolled products of iron or non-alloy steel, of a width of 600 mm or more, cold-rolled (cold-reduced), not clad, plated or coated.**	CTH

HS 2022 Code	Description of goods	Primary rules
7210	**Flat-rolled products of iron or non-alloy steel, of a width of 600 mm or more, clad, plated or coated.**	***As specified for split headings***
ex7210(a)	- Clad	CTHS
ex7210(b)	- Plated or coated with tin, and printed or lacquered	CTH
ex7210(c)	- Plated or coated with zinc, and corrugated	CTH
ex7210(d)	- Other	CTH
7211	**Flat-rolled products of iron or non-alloy steel, of a width of less than 600 mm, not clad, plated or coated.**	***As specified for split headings***
ex7211(a)	- Hot-rolled	CTH, except from heading 7208
ex7211(b)	- Cold-rolled (cold-reduced)	CTHS, except from heading 7209
7212	**Flat-rolled products of iron or non-alloy steel, of a width of less than 600 mm, clad, plated or coated.**	***As specified for split headings***
ex7212(a)	- Clad	CTHS, except from heading 7210
ex7212(b)	- Other	CTH, except from heading 7210
7213	**Bars and rods, hot-rolled, in irregularly wound coils, of iron or non-alloy steel.**	CTH, except from heading 7214
7214	**Other bars and rods of iron or non-alloy steel, not further worked than forged, hot-rolled, hot-drawn or hot-extruded, but including those twisted after rolling.**	CTH, except from heading 7213
7215	**Other bars and rods of iron or non-alloy steel.**	CTH
7216	**Angles, shapes and sections of iron or non-alloy steel.**	***As specified for split headings***

HS 2022 Code	Description of goods	Primary rules
ex7216(a)	- Not further worked than hot-rolled	CTH, except from heading 7208, 7209, 7210, 7211 or 7212, and except from heading 7213, 7214 or 7215 when this change results from cutting or bending.
ex7216(b)	- Not further worked than cold-rolled	CTH, except from heading 7209 or split heading ex7211(b), and except from heading 7215 when this change results from cutting or bending.
ex7216(c)	- Clad	CTHS
ex7216(d)	- Other	CTH, except from headings 7208 to 7215
7217	**Wire of iron or non-alloy steel.**	CTH, except from headings 7213 to 7215; or change from headings 7213 to 7215, provided the material has been cold-formed.
7218	**Stainless steel in ingots or other primary forms; semi-finished products of stainless steel.**	CTH
7219	**Flat-rolled products of stainless steel, of a width of 600 mm or more.**	***As specified for split headings***
ex7219(a)	- Not further worked than hot-rolled	CTH
ex7219(b)	- Not further worked than cold-rolled	CTHS
ex7219(c)	- Clad	CTHS
ex7219(d)	- Other	CTHS
7220	**Flat-rolled products of stainless steel, of a width of less than 600 mm.**	***As specified for split headings***
ex7220(a)	- Not further worked than hot-rolled	CTH, except from 7219
ex7220(b)	- Not further worked than cold rolled	CTHS
ex7220(c)	- Clad	CTHS
ex7220(d)	- Other	CTHS

HS 2022 Code	Description of goods	Primary rules
7221	**Bars and rods, hot-rolled, in irregularly wound coils, of stainless steel.**	CTH, except from heading 7222
7222	**Other bars and rods of stainless steel; angles, shapes and sections of stainless steel.**	***As specified for split headings***
ex7222(a)	- Bars and rods, not further worked than hot-rolled	CTH, except from heading 7221
ex7222(b)	- Angles, shapes and sections, not further worked than hot-rolled	CTH, except from heading 7219 or 7220 and except from heading 7221 or split heading ex7222(a) when this change results from cutting or bending.
ex7222(c)	- Bars and rods, angles, shapes and sections, not further worked than cold-rolled	CTH, except from split-heading ex7219(b) or ex7220(b); or CTHS from split heading ex7222(a)
ex7222(d)	- Bars and rods, angles, shapes and sections, clad	CTHS
ex7222(e)	- Other bars and rods	CTH, except from heading 7221
ex7222(f)	- Other angles, shape and sections	CTHS
7223	**Wire of stainless steel.**	CTH, except from 7221 to 7222; or change from headings 7221 to 7222, provided the material has been cold-formed.
7224	**Other alloy steel in ingots or other primary forms; semi-finished products of other alloy steel.**	CTH
7225	**Flat-rolled products of other alloy steel, of a width of 600 mm or more.**	***As specified for split headings***
ex7225(a)	- Not further worked than hot-rolled	CTH
ex7225(b)	- Not further worked than cold-rolled	CTHS
ex7225(c)	- Clad	CTHS

HS 2022 Code	Description of goods	Primary rules
ex7225(d)	- Other	CTH
7226	**Flat-rolled products of other alloy steel, of a width of less than 600 mm.**	***As specified for split headings***
ex7226(a)	- Not further worked than hot-rolled	CTH, except from heading 7225
ex7226(b)	- Not further worked than cold-rolled	CTHS, except from cold-rolled products of heading 7225
ex7226(c)	- Clad	CTHS
ex7226(d)	- Other	CTHS, except from the same subheading
7227	**Bars and rods, hot-rolled, in irregularly wound coils, of other alloy steel.**	CTH, except from heading 7228
7228	**Other bars and rods of other alloy steel; angles, shapes and sections, of other alloy steel; hollow drill bars and rods, of alloy or non-alloy steel.**	***As specified for split headings***
ex7228(a)	- Bars and rods, not further worked than hot-rolled	CTH, except from heading 7227
ex7228(b)	- Angles, shapes and sections, not further worked than hot-rolled	CTH, except from heading 7225 or 7226, and except from heading 7227 or split heading ex 7228(a) when this change results from cutting or bending.
ex7228(c)	- Bars and rods, angles, shapes and sections not further worked than cold-rolled	CTH, except from split heading ex7225(b) or ex7226(b) or CTHS from split heading ex 7228(a)
ex7228(d)	- Bars and rods, angles, shapes and sections, clad	CTHS
ex7228(e)	- Other bars and rods	CTHS
ex7228(f)	- Other angles, shapes and sections	CTHS
7229	**Wire of other alloy steel.**	CTH, except from headings 7227 to 7228; or change from headings 7227 to 7228, provided the material has been cold-formed.

CHAPTER 73

Articles of iron or steel

Chapter Note

For heading 7318, mere attachment of constituting parts without grinding to shape, heat treatment and surface treatment operation is not to be considered as origin-conferring.

Chapter residual rule:

Where the country of origin cannot be determined by application of the primary rules, the country of origin of the goods shall be the country in which the major portion of the materials originated, as determined on the basis of the value of the materials.

HS 2022 Code	Description of goods	Primary rules
7301	**Sheet piling of iron or steel, whether or not drilled, punched or made from assembled elements; welded angles, shapes and sections, of iron or steel**	CTH
7302	**Railway or tramway track construction material of iron or steel, the following: rails, check-rails and rack rails, switch blades, crossing frogs, point rods and other crossing pieces, sleepers (cross-ties), fish-plates, chairs, chair wedges, sole plates (base plates), rail clips, bedplates, ties and other material specialized for jointing or fixing rails.**	CTH
7303	**Tubes, pipes, and hollow profiles, of cast iron**	CTH
7304	**Tubes, pipes and hollow profiles, seamless, of iron (other than cast iron) or steel.**	***As specified for subheadings***
	- Line pipe of a kind used for oil or gas pipelines:	
7304 11	--Of stainless steel	CTH
7304 19	--Other	CTH
	- Casing, tubing and drill pipe, of a kind used in drilling for oil or gas	

HS 2022 Code	Description of goods	Primary rules
7304 22	-- Drill pipe of stainless steel	CTH
7304 23	-- Other drill pipe	CTH
7304 24	-- Other, of stainless steel	CTH
7304 29	-- Other	CTH
	- Other, of circular cross-section, of iron or non-alloy steel :	
7304 31	-- Cold-drawn or cold-rolled (cold-reduced)	CTH; or change from hollow profiles of subheading 7304 39
7304 39	-- Other	CTH
	- Other, of circular cross-section, of stainless steel :	
7304 41	-- Cold-drawn or cold-rolled (cold-reduced)	CTH, or change from hollow profiles of subheading 7304 49
7304 49	-- Other	CTH
	- Other, of circular cross-section, of other alloy steel :	
7304 51	-- Cold-drawn or cold-rolled (cold-reduced)	CTH, or change from hollow profiles of subheading 7304 59
7304 59	-- Other	CTH
7304 90	- Other	CTH
7305	**Other tubes and pipes (for example, welded, riveted or similarly closed), having circular cross-sections, the external diameter of which exceeds 406.4 mm, of iron or steel.**	CTH
7306	**Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel.**	CTH

HS 2022 Code	Description of goods	Primary rules
7307	**Tube or pipe fittings (for example, couplings, elbows, sleeves), of iron or steel.**	CTH
7308	**Structures (excluding prefabricated buildings of heading 9406) and parts of structures (for example, bridges and bridge-sections, lock-gates, towers, lattice masts, roofs, roofing frame-works, doors and windows and their frames and thresholds for doors, shutters, balustrades, pillars and columns), of iron or steel; plates, rods, angles, shapes, sections, tubes and the like, prepared for use in structures, of iron or steel.**	***As specified for split headings***
ex7308(a)	- Structures	CTHS
ex7308(b)	- Parts of structures	CTH
ex7308(c)	- Other	CTH, except from headings 7208 to 7216, 7301, 7304 to 7306
7309	**Reservoirs, tanks, vats and similar containers for any material (other than compressed or liquefied gas), of iron or steel, of a capacity exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment.**	CTH
7310	**Tanks, casks, drums, cans, boxes and similar containers, for any material (other than compressed or liquefied gas), of iron or steel, of a capacity not exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment.**	CTH

HS 2022 Code	Description of goods	Primary rules
7311	**Containers for compressed or liquefied gas, of iron or steel.**	CTH
7312	**Stranded wire, ropes, cables, plaited bands, slings and the like, of iron or steel, not electrically insulated.**	CTH
7313	**Barbed wire of iron or steel; twisted hoop or single flat wire, barbed or not, and loosely twisted double wire, of a kind used for fencing, of iron or steel.**	CTH
7314	**Cloth (including endless bands), grill, netting and fencing, of iron or steel wire; expanded metal of iron or steel.**	CTH
7315	**Chain and parts thereof, of iron or steel.**	CTH
7316	**Anchors, grapnels and parts thereof, of iron or steel.**	CTH
7317	**Nails, tacks, drawing pins, corrugated nails, staples (other than those of heading 8305) and similar articles, of iron or steel, whether or not with heads of other material, but excluding such articles with heads of copper.**	CTH
7318	**Screws, bolts, nuts, coach screws, screw hooks, rivets, cotters, cotter-pins, washers (including spring washers) and similar articles, of iron or steel.**	CTH

HS 2022 Code	Description of goods	Primary rules
7319	**Sewing needles, knitting needles, bodkins, crochet hooks, embroidery stilettos and similar articles, for use in the hand, of iron or steel; safety pins and other pins of iron or steel, not elsewhere specified or included.**	CTH
7320	**Springs and leaves for springs, of iron or steel.**	CTH
7321	**Stoves, ranges, grates, cookers (including those with subsidiary boilers for central heating), barbecues, braziers, gas-rings, plate warmers and similar non-electric domestic appliances and parts thereof, of iron or steel.**	CTH
7322	**Radiators for central heating, not electrically heated, and parts thereof, of iron or steel; air heaters and hot air distributors (including distributors which can also distribute fresh or conditioned air), not electrically heated, incorporating a motor-driven fan or blower, and parts thereof, of iron or steel.**	CTH
7323	**Table, kitchen or other household articles and parts thereof, of iron or steel; iron or steel wool; pot scourers and scouring or polishing pads, gloves and the like, of iron or steel.**	CTH
7324	**Sanitary ware and parts thereof, of iron or steel.**	CTH
7325	**Other cast articles of iron or steel.**	CTH
7326	**Other articles of iron or steel**	CTH

CHAPTER 74

Copper and articles thereof

Chapter Note

A change of classification solely by virtue of coiling of bars or rods to wire or uncoiling wire to bars or rods is not to be considered as origin-conferring.

Chapter residual rule:

Where the country of origin cannot be determined by application of the primary rules, the country of origin of the goods shall be the country in which the major portion of the materials originated, as determined on the basis of the value of the materials.

HS 2022 Code	Description of goods	Primary rules
7401	**Copper mattes; cement copper (precipitated copper).**	CTH
7402	**Unrefined copper; copper anodes for electrolytic refining.**	CTH
7403	**Refined copper and copper alloys, unwrought.**	***As specified for subheadings***
	- Refined copper :	
7403 11	-- Cathodes and sections of cathodes	CTH
7403 12	-- Wire-bars	CTH
7403 13	-- Billets	CTH
7403 19	-- Other	CTH
	- Copper alloys :	
7403 21	-- Copper-zinc base alloys (brass)	CTSH
7403 22	-- Copper-tin base alloys (bronze)	CTSH
7403 29	-- Other copper alloys (other than master alloys of heading 7405)	CTSH
7404	**Copper waste and scrap.**	The origin shall be the country where copper waste and scrap of this heading are derived from manufacturing or processing operations or from consumption
7405	**Master alloys of copper.**	CTH

HS 2022 Code	Description of goods	Primary rules
7406	**Copper powders and flakes.**	***As specified for subheadings***
7406 10	- Powders of non-lamellar structure	CTSH, except from split subheading ex7406 20(a)
7406 20	- Powders of lamellar structure; flakes	***As specified for split subheadings***
ex7406 20(a)	-- Powders of lamellar structure	CTSHS
ex7406 20(b)	-- Flakes	CTH
7407	**Copper bars, rods and profiles.**	CTH
7408	**Copper wire.**	CTH
7409	**Copper plates, sheets and strip, of a thickness exceeding 0.15 mm.**	***As specified for split headings***
ex7409(a)	- Cold-rolled	CTHS
ex7409(b)	- Other	CTH
7410	**Copper foil (whether or not printed or backed with paper, paperboard, plastics or similar backing materials) of a thickness (excluding any backing) not exceeding 0.15 mm.**	CTH
7411	**Copper tubes and pipes.**	CTH
7412	**Copper tube or pipe fittings (for example, couplings, elbows, sleeves).**	CTH
7413	**Stranded wire, cables, plaited bands and the like, of copper, not electrically insulated.**	CTH
[7414]		

HS 2022 Code	Description of goods	Primary rules
7415	**Nails, tacks, drawing pins, staples (other than those of heading 8305) and similar articles, of copper or of iron or steel with heads of copper; screws, bolts, nuts, screw hooks, rivets, cotters, cotter-pins, washers (including spring washers) and similar articles, of copper.**	CTH
[7416]		
[7417]		
7418	**Table, kitchen or other household articles and parts thereof, of copper; pot scourers and scouring or polishing pads, gloves and the like, of copper; sanitary ware and parts thereof, of copper.**	CTH
7419	**Other articles of copper.**	***As specified for subheadings***
7419 20	- Cast, moulded, stamped or forged, but not further worked	CTH
7419 80	- Other	
ex7419 80	--- Chain and parts thereof	CTH
ex7419 80	--- Other	CTSH

CHAPTER 75

Nickel and articles thereof

Chapter Note

A change of classification solely by virtue of coiling of bars or rods to wire or uncoiling wire to bars or rods is not to be considered as origin-conferring.

Chapter residual rule:

Where the country of origin cannot be determined by application of the primary rules, the country of origin of the goods shall be the country in which the major portion of the materials originated, as determined on the basis of the value of the materials.

HS 2022 Code	Description of goods	Primary rules
7501	**Nickel mattes, nickel oxide sinters and other intermediate products of nickel metallurgy.**	CTH, or change within this heading to mattes or sinters containing 90 % or more of nickel from mattes or sinters containing not more than 75 % of nickel
7502	**Unwrought nickel.**	***As specified for subheadings***
7502 10	- Nickel, not alloyed	CTH
7502 20	- Nickel alloys	CTSH
7503	**Nickel waste and scrap.**	The origin shall be the country where nickel waste and scrap of this heading are derived from manufacturing or processing operations or from consumption
7504	**Nickel powders and flakes.**	***As specified for split headings***
ex7504(a)	- Powders	CTHS
ex7504(b)	- Flakes	CTH
7505	**Nickel bars, rods, profiles and wire.**	CTSH
7506	**Nickel plates, sheets, strip and foil.**	***As specified for split headings***
ex7506(a)	- Nickel foil of a thickness less than 0.15 mm	CTHS
ex7506(b)	- Other	CTH

HS 2022 Code	Description of goods	Primary rules
7507	**Nickel tubes, pipes and tube or pipe fittings (for example, couplings, elbows, sleeves).**	CTSH
7508	**Other articles of nickel.**	***As specified for split headings***
ex7508(a)	- Cloth, grill and netting, of nickel wire	CTH
ex7508(b)	- Anodes for galvanization	CTH, except from the change by tapping or piercing or the addition of hooks
ex7508(c)	- Other	CTHS

CHAPTER 76

Aluminium and articles thereof

Chapter Note

A change of classification solely by virtue of coiling of bars or rods to wire or uncoiling wire to bars or rods is not to be considered as origin-conferring.

Chapter residual rule:

Where the country of origin cannot be determined by application of the primary rules, the country of origin of the goods shall be the country in which the major portion of the materials originated, as determined on the basis of the value of the materials.

HS 2022 Code	Description of goods	Primary rules
7601	**Unwrought aluminium**	***As specified for subheadings***
7601 10	- Aluminium, not alloyed	***As specified for split subheadings***
ex7601 10(a)	- Of a purity of 99.9 % or more	CTSHS
ex7601 10(b)	- Other	CTH
7601 20	- Aluminium alloys	CTSH
7602	**Aluminium waste and scrap**	The origin shall be the country where aluminium waste and scrap of this heading are derived from manufacturing or processing operations or from consumption
7603	**Aluminium powders and flakes**	***As specified for subheadings***
7603 10	- Powders of non-lamellar structure	CTSH, except from split heading ex7603 20(a)
7603 20	- Powders of lamellar structure; flakes	***As specified for split subheadings***
ex7603 20(a)	-- Powders of lamellar structure	CTSHS
ex7603 20(b)	-- Flakes	CTH
7604	**Aluminium bars, rods and profiles**	CTH
7605	**Aluminium wire**	CTH
7606	**Aluminium plates, sheets and strip, of a thickness exceeding 0.2 mm**	CTH

HS 2022 Code	Description of goods	Primary rules
7607	**Aluminium foil (whether or not printed or backed with paper, paperboard, plastics or similar backing materials) of a thickness (excluding any backing) not exceeding 0.2 mm.**	***As specified for subheadings***
	- Not backed:	
7607 11	-- Rolled but not further worked	CTH
7607 19	-- Other	CTH
7607 20	- Backed	CTH
7608	Aluminium tubes and pipes.	CTH
7609	Aluminium tube or pipe fittings (for example, couplings, elbows, sleeves).	CTH
7610	**Aluminium structures (excluding prefabricated buildings of heading 9406) and parts of structures (for example, bridges and bridge-sections, towers, lattice masts, roofs, roofing frameworks, doors and windows and their frames and thresholds for doors, balustrades, pillars and columns); aluminium plates, rods, profiles, tubes and the like, prepared for use in structures.**	***As specified for split headings***
ex7610(a)	Structures	CTHS
ex7610(b)	Parts of structures	CTH
ex7610(c)	Other	CTH, except from heading 7604, 7605, 7606, 7608 or 7609

HS 2022 Code	Description of goods	Primary rules
7611	**Aluminium reservoirs, tanks, vats and similar containers, for any material (other than compressed or liquefied gas), of a capacity exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment.**	CTH
7612	**Aluminium casks, drums, cans, boxes and similar containers (including rigid or collapsible tubular containers), for any material (other than compressed or liquefied gas), of a capacity not exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment.**	CTH
7613	**Aluminium containers for compressed or liquefied gas.**	CTH
7614	**Stranded wire, cables, plaited bands and the like, of aluminium, not electrically insulated.**	CTH
7615	**Table, kitchen or other household articles and parts thereof, of aluminium; pot scourers and scouring or polishing pads, gloves and the like, of aluminium; sanitary ware and parts thereof, of aluminium.**	CTH
7616	**Other articles of aluminium.**	***As specified for subheadings***
7616 10	- Nails, tacks, staples (other than those of heading 8305), screws, bolts, nuts, screw hooks, rivets, cotters, cotter-pins, washers and similar articles	CTH
	- Other	
7616 91	-- Cloth, grill, netting and fencing, of aluminium wire	CTH

HS 2022 Code	Description of goods	Primary rules
7616 99	-- Other	CTSH

CHAPTER 78

Lead and articles thereof

Chapter Note

A change of classification solely by virtue of coiling of bars or rods to wire or uncoiling wire to bars or rods is not to be considered as origin conferring.

Chapter residual rule:

Where the country of origin cannot be determined by application of the primary rules, the country of origin of the goods shall be the country in which the major portion of the materials originated, as determined on the basis of the value of the materials.

HS 2022 Code	Description of goods	Primary rules
7801	**Unwrought lead.**	***As specified for subheadings***
7801 10	- Refined lead	CTSH
	- Other :	
7801 91	-- Containing by weight antimony as the principal other element	CTH
7801 99	-- Other	*As specified for split subheadings*
ex7801 99(a)	Alloys	CTSH
ex7801 99(b)	Other	CTH
7802	**Lead waste and scrap**	The origin shall be the country where lead waste and scrap of this heading are derived from manufacturing or processing operations or from consumption
[7803]		
7804	**Lead plates, sheets, strip and foil; lead powders and flakes.**	***As specified for split headings***
ex7804(a)	- Lead foil	CTHS
ex7804(b)	- Powders	CTHS
ex7804(c)	- Flakes	CTHS, except from split heading ex 7804(b)
ex7804(d)	- Other	CTHS
[7805]		
7806	Other articles of lead.	CTH

CHAPTER 79

Zinc and articles thereof

Chapter Note

A change of classification solely by virtue of coiling of bars or rods to wire or uncoiling wire to bars or rods is not to be considered as origin conferring.

Chapter residual rule:

Where the country of origin cannot be determined by application of the primary rules, the country of origin of the goods shall be the country in which the major portion of the materials originated, as determined on the basis of the value of the materials.

HS 2022 Code	Description of goods	Primary rules
7901	**Unwrought zinc.**	***As specified for split headings***
ex7901(a)	- Alloys	CTHS
ex7901(b)	- Other	CTH
7902	**Zinc waste and scrap.**	The origin shall be the country where zinc waste and scrap of this heading are derived from manufacturing or processing operations or from consumption
7903	**Zinc dust, powders and flakes.**	***As specified for subheadings***
7903 10	- Zinc dust	CTH
7903 90	- Other	*As specified for split subheadings*
ex7903 90(a)	-- Powders	CTSHS
ex7903 90(b)	-- Other	CTH
7904	**Zinc bars, rods, profiles and wire.**	***As specified for split headings***
ex7904(a)	- Bars, rods and profiles	CTH
ex7904(b)	- Wire	CTHS
7905	**Zinc plates, sheets, strip and foil.**	CTH
[7906]		
7907	**Other articles of zinc.**	***As specified for split headings***

HS 2022 Code	Description of goods	Primary rules
ex7907(a)	- Electroplating anodes	CTH, except from the change by tapping or piercing or the addition of hooks
ex7907(b)	- Other	CTH

CHAPTER 80

Tin and articles thereof

Chapter Note

A change of classification solely by virtue of coiling of bars or rods to wire or uncoiling wire to bars or rods is not to be considered as origin conferring.

Chapter residual rule:

Where the country of origin cannot be determined by application of the primary rules, the country of origin of the goods shall be the country in which the major portion of the materials originated, as determined on the basis of the value of the materials.

HS 2022 Code	Description of goods	Primary rules
8001	**Unwrought tin**	***As specified for subheadings***
8001 10	- Tin, not alloyed	CTH or manufacture of refined tin of this subheading from unrefined tin of the same subheading.
8001 20	- Tin alloys	CTSH
8002	**Tin waste and scrap**	The origin shall be the country where tin waste and scrap of this heading are derived from manufacturing or processing operations or from consumption.
8003	**Tin bars, rods, profiles and wire**	***As specified for split headings***
ex8003(a)	Bars, rods, profiles	CTH
ex8003(b)	Wire	CTHS
[8004]		
[8005]		
[8006]		
8007	**Other articles of tin**	***As specified for split headings***
ex8007(a)	- Electroplating anodes	CTH, except from the change by tapping or piercing or the addition of hooks
ex8007(b)	- Other	CTH

CHAPTER 81

Other base metals; cermets; articles thereof

Chapter Note

A change of classification solely by virtue of coiling of bars or rods to wire or uncoiling wire to bars or rods is not to be considered as origin conferring.

Chapter residual rule:

Where the country of origin cannot be determined by application of the primary rules, the country of origin of the goods shall be the country in which the major portion of the materials originated, as determined on the basis of the value of the materials.

HS 2022 Code	Description of goods	Primary rules
8101	**Tungsten (wolfram) and articles thereof, including waste and scrap**	***As specified for split headings***
ex8101(a)	- Alloys	CTHS
ex8101(b)	- Refined tungsten	CTHS
ex8101(c)	- Waste and scrap	The origin shall be the country where the waste and scrap of this split heading are derived from manufacturing or processing operations or from consumption
ex8101(d)	- Bars and rods, other than those obtained simply by sintering, profiles	CTHS
ex8101(e)	- Plates, sheets, strip and foil	CTHS; or cold-rolling from articles of the same split heading
ex8101(f)	- Wire	CTHS
ex8101(g)	- Tubes and pipes	CTHS; or cold-rolling from articles of the same split heading
ex8101(h)	- Tube or pipe fittings	CTHS
ex8101(i)	- Powders	CTHS
ex8101(j)	- Flakes	CTHS
ex8101(k)	- Cables	CTHS
ex8101(l)	- Other	CTHS

HS 2022 Code	Description of goods	Primary rules
8102	**Molybdenum and articles thereof, including waste and scrap.**	***As specified for split headings***
ex8102(a)	- Alloys	CTHS
ex8102(b)	- Refined molybdenum	CTHS
ex8102(c)	- Waste and scrap	The origin shall be the country where the waste and scrap of this split heading are derived from manufacturing or processing operations or from consumption
ex8102(d)	- Bars and rods, other than those obtained simply by sintering , profiles	CTHS
ex8102(e)	- Plates, sheets, strip and foil	CTHS; or cold-rolling from articles of the same split heading
ex8102(f)	- Wire	CTHS
ex8102(g)	- Tubes and pipes	CTH; or cold-rolling from articles of the same split heading.
ex8102(h)	- Tube or pipe fittings	CTHS
ex8102(i)	- Powders	CTHS
ex8102(j)	- Flakes	CTHS
ex8102(k)	- Cables	CTHS
ex8102(l)	- Other	CTHS
8103	**Tantalum and articles thereof, including waste and scrap.**	***As specified for split headings***
ex8103(a)	- Alloys	CTHS
ex8103(b)	- Refined tantalum	CTHS
ex8103(c)	- Waste and scrap	The origin shall be the country where the waste and scrap of this split heading are derived from manufacturing or processing operations or from consumption
ex8103(d)	- Bars and rods, other than those obtained simply by sintering ,profiles	CTHS

HS 2022 Code	Description of goods	Primary rules
ex8103(e)	- Plates, sheets, strip and foil	CTHS; or cold- rolling from articles of the same split heading
ex8103(f)	- Wire	CTHS
ex8103(g)	- Tubes and pipes	CTHS; or cold-rolling from articles of the same split heading
ex8103(h)	- Tube or pipe fittings	CTHS
ex8103(i)	- Powders	CTHS
ex8103(j)	- Flakes	CTHS
ex8103(k)	- Cables	CTHS
ex8103(l)	- Other	CTHS
8104	**Magnesium and articles thereof, including waste and scrap.**	***As specified for split headings***
ex8104(a)	- Alloys	CTHS
ex8104(b)	- Refined magnesium	CTHS
ex8104(c)	- Waste and scrap	The origin shall be the country where the waste and scrap of this split heading are derived from manufacturing or processing operations or from consumption
ex8104(d)	- Bars and rods, other than those obtained simply by sintering , profiles	CTHS
ex8104(e)	- Plates, sheets, strip and foil	CTHS; or cold- rolling from articles of the same split heading
ex8104(f)	- Wire	CTHS
ex8104(g)	- Tubes and pipes	CTHS, or cold-rolling from articles of the same split heading
ex8104(h)	- Tube or pipe fittings	CTHS
ex8104(i)	- Powders	CTHS
ex8104(j)	- Flakes	CTHS
ex8104(k)	- Cables	CTHS
ex8104(l)	- Other	CTHS

HS 2022 Code	Description of goods	Primary rules
8105	**Cobalt mattes and other intermediate products of cobalt metallurgy; cobalt and articles thereof, including waste and scrap.**	***As specified for split headings***
ex8105(a)	- Alloys	CTHS
ex8105(b)	- Refined cobalt	CTHS
ex8105(c)	- Waste and scrap	The origin shall be the country where the waste and scrap of this split heading are derived from manufacturing or processing operations or from consumption
ex8105(d)	- Bars and rods, other than those obtained simply by sintering , profiles	CTHS
ex8105(e)	- Plates, sheets, strip and foil	CTHS; or cold- rolling from articles of the same split heading
ex8105(f)	- Wire	CTHS
ex8105(g)	- Tubes and pipes	CTHS; or cold- rolling from articles of the same split heading
ex8105(h)	- Tube or pipe fittings	CTHS
ex8105(i)	- Powders	CTHS
ex8105(j)	- Flakes	CTHS
ex8105(k)	- Cables	CTHS
ex8105(l)	- Other	CTHS
8106	**Bismuth and articles thereof, including waste and scrap.**	***As specified for split headings***
ex8106(a)	- Alloys	CTHS
ex8106(b)	- Refined bismuth	CTHS
ex8106(c)	- Waste and scrap	The origin shall be the country where the waste and scrap of this split heading are derived from manufacturing or processing operations or from consumption
ex8106(d)	- Bars and rods, other than those obtained simply by sintering ,profiles	CTHS

HS 2022 Code	Description of goods	Primary rules
ex8106(e)	- Plates, sheets, strip and foil	CTHS; or cold-rolling from articles of the same split heading
ex8106(f)	- Wire	CTHS
ex8106(g)	- Tubes and pipes	CTHS; or cold-rolling from articles of the same split heading.
ex8106(h)	- Tube or pipe fittings	CTHS
ex8106(i)	- Powders	CTHS
ex8106(j)	- Flakes	CTHS
ex8106(k)	- Cables	CTHS
ex8106(l)	- Other	CTHS

HS 2022 Code	Description of goods	Primary rules
8108	**Titanium and articles thereof, including waste and scrap.**	***As specified for split headings***
ex8108(a)	- Alloys	CTHS
ex8108(b)	- Refined titanium	CTHS
ex8108(c)	- Waste and scrap	The origin shall be the country where the waste and scrap of this split heading are derived from manufacturing or processing operations or from consumption
ex8108(d)	- Bars and rods, other than those obtained simply by sintering ,profiles	CTHS
ex8108(e)	- Plates, sheets, strip and foil	CTHS; or cold-rolling from articles of the same split heading
ex8108(f)	- Wire	CTHS
ex8108(g)	- Tubes and pipes	CTHS; or cold-rolling from articles of the same split heading
ex8108(h)	- Tube or pipe fittings	CTHS
ex8108(i)	- Powders	CTHS
ex8108(j)	- Flakes	CTHS
ex8108(k)	- Cables	CTHS
ex8108(l)	- Other	CTHS
8109	**Zirconium and articles thereof, including waste and scrap.**	***As specified for split headings***
ex8109(a)	- Alloys	CTHS
ex8109(b)	- Refined zirconium	CTHS
ex8109(c)	- Waste and scrap	The origin shall be the country where the waste and scrap of this split heading are derived from manufacturing or processing operations or from consumption
ex8109(d)	- Bars and rods, other than those obtained simply by sintering ,profiles	CTHS

HS 2022 Code	Description of goods	Primary rules
ex8109(e)	- Plates, sheets, strip and foil	CTHS; or cold-rolling from articles of the same split heading
ex8109(f)	- Wire	CTHS
ex8109(g)	- Tubes and pipes	CTHS; or cold-rolling from articles of the same split heading
ex8109(h)	- Tube or pipe fittings	CTHS
ex8109(i)	- Powders	CTHS
ex8109(j)	- Flakes	CTHS
ex8109(k)	- Cables	CTHS
ex8109(l)	- Other	CTHS
8110	**Antimony and articles thereof, including waste and scrap.**	***As specified for split headings***
ex8110(a)	- Alloys	CTHS
ex8110(b)	- Refined antimony	CTHS
ex8110(c)	- Waste and scrap	The origin shall be the country where the waste and scrap of this split heading are derived from manufacturing or processing operations or from consumption
ex8110(d)	- Bars and rods, other than those obtained simply by sintering ,profiles	CTHS
ex8110(e)	- Plates, sheets, strip and foil	CTHS; or cold-rolling from articles of the same split heading
ex8110(f)	- Wire	CTHS
ex8110(g)	- Tubes and pipes	CTHS; or cold-rolling from articles of the same split heading
ex8110(h)	- Tube or pipe fittings	CTHS
ex8110(i)	- Powders	CTHS
ex8110(j)	- Flakes	CTHS
ex8110(k)	- Cables	CTHS
ex8110(l)	- Other	CTHS

HS 2022 Code	Description of goods	Primary rules
8111	**Manganese and articles thereof, including waste and scrap.**	***As specified for split headings***
ex8111(a)	- Alloys	CTHS
ex8111(b)	- Refined manganese	CTHS
ex8111(c)	- Waste and scrap	The origin shall be the country where the waste and scrap of this split heading are derived from manufacturing or processing operations
ex8111(d)	- Bars and rods, other than those obtained simply by sintering profiles	CTHS
ex8111(e)	- Plates, sheets, strip and foil	CTHS; or cold-rolling from articles of the same split heading
ex8111(f)	- Wire	CTHS
ex8111(g)	- Tubes and pipes	CTHS; or cold-rolling from articles of the same split heading
ex8111(h)	- Tube or pipe fittings	CTHS
ex8111(i)	- Powders	CTHS
ex8111(j)	- Flakes	CTHS
ex8111(k)	- Cables	CTHS
ex8111(l)	- Other	CTHS
8112	**Beryllium, chromium, hafnium, rhenium, thallium, cadmium, germanium, vanadium, gallium, indium and niobium (columbium), articles of these metals, including waste and scrap..**	***As specified for split subheadings***
	- Beryllium**:**	
8112 12	-- Unwrought; powders	***As specified for split subheadings***
ex8112 12(a)	--- Alloys	CTSHS
ex8112 12(b)	--- Refined beryllium	CTHS

HS 2022 Code	Description of goods	Primary rules
ex8112 12(c)	--- Powders	CTSHS
8112 13	-- Waste and scrap	The origin shall be the country where the waste and scrap of this split subheading are derived from manufacturing or processing operations or from consumption
8112 19	-- Other	***As specified for split subheadings***
ex8112 19(a)	--- Bars and rods, other than those obtained simply by sintering and profiles	CTSHS
ex8112 19(b)	--- Plates, sheets, strip and foil	CTSHS; or cold-rolling from articles of the same split subheading
ex8112 19(c)	--- Wire	CTSHS
ex8112 19(d)	--- Tubes and pipes	CTSHS; or cold-rolling from articles of the same split subheading
ex8112 19(e)	--- Tube or pipe fittings	CTSHS
ex8112 19(f)	--- Flakes	CTSHS
ex8112 19(g)	--- Cables	CTSHS
ex8112 19(h)	--- Other	CTSHS
	- Chromium	***As specified for split subheadings***
8112 21	--Unwrought, powders	
ex8112 21(a)	-- Alloys	CTSHS
ex8112 21(b)	-- Refined chromium	CTHS
ex8112 21(c)	-- Powders	CTSHS
8112 22	-- Waste and scrap	The origin shall be the country where the waste and scrap of this split subheading are derived from manufacturing or processing operations or from consumption
8112 29	--Other	
ex8112 29(a)	-- Bars and rods, other than those obtained simply by sintering, profiles	CTSHS
ex8112 29(b)	-- Plates, sheets, strip and foil	CTSHS; or cold-rolling from articles of the same split subheading
ex8112 29(c)	-- Wire	CTSHS

HS 2022 Code	Description of goods	Primary rules
ex8112 29(d)	-- Tubes and pipes	CTSHS; or cold-rolling from articles of the same split subheading
ex8112 29(e)	-- Tube or pipe fittings	CTSHS
ex8112 29(f)	-- Flakes	CTSHS
ex8112 29(g)	-- Cables	CTSHS
ex8112 29(h)	-- Other	CTSHS
	- Hafnium :	
8112 31	-- Unwrought; waste and scrap; powders	
ex8112 31(a)	--- Alloys	CTSHS
ex8112 31(b)	--- Refined metals	CTHS
ex8112 31(c)	--- Waste and scrap	The origin shall be the country where the waste and scrap of this split subheading are derived from manufacturing or processing operations or from consumption
ex8112 31(d)	--- Powders	CTSHS
8112 39	-- Other	
ex8112 39(a)	--- Bars and rods, other than those obtained simply by sintering ,profiles	CTSHS
ex8112 39(b)	--- Plates, sheets, strip and foil	CTSHS; or cold-rolling from articles of the same split subheading
ex8112 39(c)	--- Wire	CTSHS
ex8112 39(d)	--- Tubes and pipes	CTSHS; or cold-rolling from articles of the same split subheading.
ex8112 39(e)	--- Tube or pipe fittings	CTSHS
ex8112 39(f)	--- Flakes	CTSHS
ex8112 39(g)	--- Cables	CTSHS
ex8112 39(h)	--- Other	CTSHS
	- Rhenium :	
8112 41	-- Unwrought; waste and scrap; powders	
ex8112 41(a)	--- Alloys	CTSHS

HS 2022 Code	Description of goods	Primary rules
ex8112 41(b)	--- Refined metals	CTHS
ex8112 41(c)	--- Waste and scrap	The origin shall be the country where the waste and scrap of this split subheading are derived from manufacturing or processing operations or from consumption
ex8112 41(d)	--- Powders	CTSHS
8112 49	-- Other	
ex8112 49(a)	--- Bars and rods, other than those obtained simply by sintering ,profiles	CTSHS
ex8112 49(b)	--- Plates, sheets, strip and foil	CTSHS; or cold-rolling from articles of the same split subheading
ex8112 49(c)	--- Wire	CTSHS
ex8112 49(d)	--- Tubes and pipes	CTSHS; or cold-rolling from articles of the same split subheading.
ex8112 49(e)	--- Tube or pipe fittings	CTSHS
ex8112 49(f)	--- Flakes	CTSHS
ex8112 49(g)	--- Cables	CTSHS
ex8112 49(h)	--- Other	CTSHS
	-Thallium:	
8112 51	-- Unwrought; powders	***As specified for split subheadings***
ex8112 51(a)	--- Alloys	CTSHS
ex8112 51(b)	--- Refined metals	CTHS
ex8112 51(c)	--- Powders	CTSHS
8112 52	-- Waste and scrap	The origin shall be the country where the waste and scrap of this split subheading are derived from manufacturing or processing operations or from consumption
8112 59	-- Other	***As specified for split subheadings***
ex8112 59(a)	--- Bars and rods, other than those obtained simply by sintering ,profiles	CTSHS
ex8112 59(b)	--- Plates, sheets, strip and foil	CTSHS; or cold-rolling from articles of the same split subheading

HS 2022 Code	Description of goods	Primary rules
ex8112 59(c)	--- Wire	CTSHS
ex8112 59(d)	--- Tubes and pipes	CTSHS; or cold-rolling from articles of the same split subheading.
ex8112 59(e)	--- Tube or pipe fittings	CTSHS
ex8112 59(f)	--- Flakes	CTSHS
ex8112 59(g)	--- Cables	CTSHS
ex8112 59(h)	--- Other	CTSHS
	- Cadmium :	
8112 61	-- Waste and scrap	The origin shall be the country where the waste and scrap of this split subheading are derived from manufacturing or processing operations or from consumption
8112 69	-- Other	***As specified for split subheadings***
ex8112 69(a)	--- Alloys	CTHS
ex8112 69 (b)	--- Refined cadmium	CTHS
ex8112 69 (d)	--- Bars and rods, other than those obtained simply by sintering ,profiles	CTHS
ex8112 69 (e)	--- Plates, sheets, strip and foil	CTHS; or cold-rolling from articles of the same split heading
ex8112 69 (f)	--- Wire	CTHS
ex8112 69 (g)	--- Tubes and pipes	CTHS; or cold-rolling from articles of the same split heading.
ex8112 69 (h)	--- Tube or pipe fittings	CTHS
ex8112 69 (i)	--- Powders	CTHS
ex8112 69 (j)	--- Flakes	CTHS
ex8112 69 (k)	--- Cables	CTHS
ex8112 69 (l)	--- Other	CTHS
	- Other :	
8112 92	-- Unwrought; waste and scrap; powders	***As specified for split subheadings***
ex8112 92(a)	--- Alloys	CTSHS

HS 2022 Code	Description of goods	Primary rules
ex8112 92(b)	--- Refined metals	CTHS
ex8112 92(c)	--- Waste and scrap	The origin shall be the country where the waste and scrap of this split subheading are derived from manufacturing or processing operations or from consumption
ex8112 92(d)	--- Powders	CTSHS
8112 99	-- Other	***As specified for split subheadings***
ex8112 99(a)	--- Bars and rods, other than those obtained simply by sintering ,profiles	CTSHS
ex8112 99(b)	--- Plates, sheets, strip and foil	CTSHS; or cold-rolling from articles of the same split subheading
ex8112 99(c)	--- Wire	CTSHS
ex8112 99(d)	--- Tubes and pipes	CTSHS; or cold-rolling from articles of the same split subheading.
ex8112 99(e)	--- Tube or pipe fittings	CTSHS
ex8112 99(f)	--- Flakes	CTSHS
ex8112 99(g)	--- Cables	CTSHS
ex8112 99(h)	--- Other	CTSHS
8113	**Cermets and articles thereof, including waste and scrap**	***As specified for split headings***
ex8113(a)	- Unwrought cermets	CTHS
ex8113(b)	- Waste and scrap	The origin shall be the country where the waste and scrap of this split heading are derived from manufacturing or processing operations or from consumption
ex8113(c)	- Powders	CTHS
ex8113(d)	- Flakes	CTHS
ex8113(e)	- Bars and rods ,profiles	CTHS
ex8113(f)	- Wire	CTHS
ex8113(g)	- Tubes and pipes	CTHS; or cold-rolling from articles of the same split subheading.
ex8113(h)	- Tube or pipe fittings	CTHS

HS 2022 Code	Description of goods	Primary rules
ex8113(i)	- Cables	CTHS
ex8113(j)	- Other	CTHS

CHAPTER 82

Tools, implements, cutlery, spoons and forks, of base metal; parts thereof of base metal

Primary Rule: Goods or parts produced from blanks

(a) The country of origin of a good or part produced from a blank which by application of the Harmonized System General Interpretative Rule 2(a) is classified in the same heading, subheading or subdivision as the complete or finished good or part, shall be the country in which every working edge, working surface and working part was configured to final shape and dimension, provided, in its imported condition, the blank from which it was produced:

(i) was not capable of functioning, and

(ii) was not advanced beyond the initial stamping process or any processing required to remove the material from the forging platter or casting mould;

(b) If the criteria in paragraph (a) are not satisfied, the country of origin is the country of origin of the blank of this Chapter.

Chapter residual rule:

Where the country of origin cannot be determined by application of the primary rules, the country of origin of the goods shall be the country in which the major portion of the materials originated, as determined on the basis of the value of the materials.

HS 2022 Code	Description of goods	Primary rules
8201	**Hand tools, the following : spades, shovels, mattocks, picks, hoes, forks and rakes; axes, bill hooks and similar hewing tools; secateurs and pruners of any kind; scythes, sickles, hay knives, hedge shears, timber wedges and other tools of a kind used in agriculture, horticulture or forestry.**	CTH
8202	**Hand saws; blades for saws of all kinds (including slitting, slotting or toothless saw blades).**	***As specified for subheadings***
8202 10	- Hand saws	CTH
8202 20	- Band saw blades	CTSH
	- Circular saw blades (including slitting or slotting saw blades) :	
8202 31	-- With working part of steel	CTSH
8202 39	-- Other, including parts	***As specified for split subheadings***

HS 2022 Code	Description of goods	Primary rules
ex8202 39(a)	-- Saw teeth and tooth segments for circular saws	CTH
ex8202 39(b)	-- Other	CTSHS
8202 40	- Chain saw blades	***As specified for split subheadings***
ex8202 40(a)	-- Saw teeth and tooth segments for chain saws	CTH
ex8202 40(b)	-- Other	CTSHS
	- Other saw blades:	
8202 91	-- Straight saw blades, for working metal	CTSH
8202 99	-- Other	CTSH
8203	**Files, rasps, pliers (including cutting pliers), pincers, tweezers, metal cutting shears, pipe-cutters, bolt croppers, perforating punches and similar hand tools.**	CTSH
8204	**Hand-operated spanners and wrenches (including torque meter wrenches but not including tap wrenches); interchangeable spanner sockets, with or without handles.**	CTSH
8205	**Hand tools (including glaziers' diamonds), not elsewhere specified or included; blow lamps; vices, clamps and the like, other than accessories for and parts of, machine tools; anvils; portable forges; hand or pedal-operated grinding wheels with frameworks.**	CTH
8206	**Tools of two or more of the headings 8202 to 8205, put up in sets for retail sale.**	CTH

HS 2022 Code	Description of goods	Primary rules
8207	**Interchangeable tools for hand tools, whether or not power-operated, or for machine-tools (for example, for pressing, stamping, punching, tapping, threading, drilling, boring, broaching, milling, turning or screw driving), including dies for drawing or extruding metal, and rock drilling or earth boring tools.**	***As specified for subheadings***
	- Rock drilling or earth boring tools:	
8207 13	-- With working part of cermets	CTSH
8207 19	-- Other, including parts	***As specified for split subheadings***
ex8207 19(a)	-- Parts	CTH
ex8207 19(b)	-- Other	CTSHS
8207 20	- Dies for drawing or extruding metal	CTSH
8207 30	- Tools for pressing, stamping or punching	CTSH
8207 40	- Tools for tapping or threading	CTSH
8207 50	- Tools for drilling, other than for rock drilling	CTSH
8207 60	- Tools for boring or broaching	CTSH
8207 70	- Tools for milling	CTSH
8207 80	- Tools for turning	CTSH
8207 90	- Other interchangeable tools	CTSH
8208	**Knives and cutting blades, for machines or for mechanical appliances.**	CTSH
8209	**Plates, sticks, tips and the like for tools, unmounted, of cermets.**	CTH

HS 2022 Code	Description of goods	Primary rules
8210	**Hand-operated mechanical appliances, weighing 10 kg or less, used in the preparation, conditioning or serving of food or drink.**	CTH
8211	**Knives with cutting blades, serrated or not (including pruning knives), other than knives of heading 8208, and blades therefor.**	CTH
8212	**Razors and razor blades (including razor blade blanks in strips).**	CTH
8213	**Scissors, tailors' shears and similar shears, and blades therefor.**	CTH
8214	**Other articles of cutlery (for example, hair clippers, butchers' or kitchen cleavers, choppers and mincing knives, paper knives); manicure or pedicure sets and instruments (including nail files).**	CTH
8215	**Spoons, forks, ladles, skimmers, cake-servers, fish-knives, butter-knives, sugar tongs and similar kitchen or tableware.**	***As specified for subheadings***
8215 10	- Sets of assorted articles containing at least one article plated with precious metal	CTH
8215 20	- Other sets of assorted articles	CTH
	- Other:	
8215 91	-- Plated with precious metal	CTH
8215 99	-- Other	CTH

CHAPTER 83

Miscellaneous articles of base metal

Primary Rule: Goods or parts produced from blanks

The country of origin of a good or part produced from a blank which by application of the Harmonized System General Interpretative Rule 2(a) is classified in the same heading, subheading or subdivision as the complete or finished good or part, shall be the country in which the blank was finished, provided finishing included configuring to final shape by the removal of material (other than merely by honing or polishing or both), or by forming processes such as bending, hammering, pressing or stamping.

Chapter residual rule:

Where the country of origin cannot be determined by application of the primary rules, the country of origin of the goods shall be the country in which the major portion of the materials originated, as determined on the basis of the value of the materials.

HS 2022 Code	Description of goods	Primary rules
8301	**Padlocks and locks (key, combination or electrically operated), of base metal; clasps and frames with clasps, incorporating locks, of base metal; keys for any of the foregoing articles, of base metal.**	***As specified for subheadings***
8301 10	- Padlocks	***As specified for split subheadings***
ex8301 10(a)	- Padlocks, key or combination	CTH
ex8301 10(b)	- Padlocks, electrically operated	CTH, or change from subheading 8301 60
8301 20	- Locks of a kind used for motor vehicles	***As specified for split subheadings***
ex8301 20(a)	- Locks of a kind used for motor vehicles, key or combination	CTH
ex8301 20(b)	- Locks of a kind used for motor vehicles, electrically operated	CTH, or change from subheading 8301 60

HS 2022 Code	Description of goods	Primary rules
8301 30	- Locks of a kind used for furniture	***As specified for split subheadings***
ex8301 30(a)	- Locks of a kind used for furniture, key or combination	CTH
ex8301 30(b)	- Locks of a kind used for furniture, electrically operated	CTH, or change from subheading 8301 60
8301 40	- Other locks	***As specified for split subheadings***
ex8301 40(a)	- Other Locks, key or combination	CTH
ex8301 40(b)	- Other Locks, electrically operated	CTH, or change from subheading 8301 60
8301 50	- Clasps and frames with clasps, incorporating locks	CTH
8301 60	- Parts	CTH
8301 70	- Keys presented separately	CTH
8302	**Base metal mountings, fittings and similar articles suitable for furniture, doors, staircases, windows, blinds, coachwork, saddlery, trunks, chests, caskets or the like; base metal hat-racks, hat-pegs, brackets and similar fixtures; castors with mountings of base metal; automatic door closers of base metal.**	CTH
8303	**Armoured or reinforced safes, strong-boxes and doors and safe deposit lockers for strong-rooms, cash or deed boxes and the like, of base metal.**	***As specified for split headings***
ex8303(a)	Armoured or reinforced safes, strong-boxes and doors and safe deposit lockers for strong-rooms, cash or deed boxes and the like, of base metal.	CTHS
ex8303(b)	Parts of base metal	CTH

HS 2022 Code	Description of goods	Primary rules
8304	**Filing cabinets, card-index cabinets, paper trays, paper rests, pen trays, office-stamp stands and similar office or desk equipment, of base metal, other than office furniture of heading 9403.**	CTH
8305	**Fittings for loose-leaf binders or files, letter clips, letter corners, paper clips, indexing tags and similar office articles, of base metal; staples in strips (for example, for offices, upholstery, packaging), of base metal.**	CTH
8306	**Bells, gongs and the like, non-electric, of base metal; statuettes and other ornaments, of base metal; photograph, picture or similar frames, of base metal; mirrors of base metal.**	CTH
8307	**Flexible tubing of base metal, with or without fittings.**	CTH
8308	**Clasps, frames with clasps, buckles, buckle-clasps, hooks, eyes, eyelets and the like, of base metal, of a kind used for clothing, footwear, awnings, handbags, travel goods or other made up articles; tubular or bifurcated rivets, of base metal; beads and spangles, of base metal.**	CTH

HS 2022 Code	Description of goods	Primary rules
8309	**Stoppers, caps and lids (including crown corks, screw caps and pouring stoppers), capsules for bottles, threaded bungs, bung covers, seals and other packing accessories, of base metal.**	CTH
8310	**Sign-plates, name-plates, address-plates and similar plates, numbers, letters and other symbols, of base metal, excluding those of heading 9405.**	CTH
8311	**Wire, rods, tubes, plates, electrodes and similar products, of base metal or of metal carbides, coated or cored with flux material, of a kind used for soldering, brazing, welding or deposition of metal or of metal carbides; wire and rods, of agglomerated base metal powder, used for metal spraying.**	CTH

ENVIRONMENTAL PRODUCT DECLARATION

According to ISO 14025

Declaration Holder	**Outokumpu Oyj**
Editor	Environmental Construction Products Organisation (ECO)
Programm holder	Institut Bauen und Umwelt e.V.
Declaration number	ECO-OUT-00020101-1106
Date of issue	28.06.2011
Validity Date	27.06.2016

Cold Rolled Stainless Steel
Outokumpu Oyj

www.eco-europe.org

01 Summary

Outokumpu Cold Rolled Stainless Steel

Program holder
IBU - Institut Bauen und Umwelt e.V.
Rheinufer108
D-53639 Königswinter
Germany

Declaration number
ECO- OUT-00020101-1106

LCA Practitioner
PE INTERNATIONAL AG

This declaration is based on the PCR document
Carbon and stainless steel in construction, 2011-05 (reviewed by IBU third party independent expert committee).

Date of issue 28.06.2011

Validity date 27.06.2014

Declaration holder
Outokumpu Oyj
Riihitontuntie 7
FI-02201 ESPOO
Finland

Declared product/Declared unit
This EPD applies to 1 ton of cold rolled stainless steel. It covers steel delivered as sheet or as plate for various applications for building and civil work.

Verification

Product Category Rules 'Carbon and stainless steel in construction' serves as guidance
Third party independent verification of the declaration, according to ISO 14025
☐ internal ☒ external

Hans Peters, CEO of IBU

Dr. Eva Schmincke, third party verifier

Declared unit: 1 ton of cold rolled stainless steel

Table 1: overview impact categories

Total LCIA Results						
Environmental Parameters	**Unit per ton**	**Product stage**	*Construction Process Stage*	*Use Stage*	*End-of-Life stage*	**Benefits and loads beyond the system boundary**
Primary Energy Demand from Renewable Resources	[MJ]	10.346,29	Module not assessed	Module not assessed	Module not assessed	-1.081,12
Primary Energy Demand from Non-renewable Resources	[MJ]	44.618,46				-17.396,81
Abiotic Depletion (ADP elements)	[kg Sb eqv.]	0,11				-0,05
Abiotic Depletion (ADP fossil)	[MJ]	30.912,40				-13.870,12
Global Warming Potential (GWP 100 year)	[kg CO_2-eqv.]	3.005,96				-1.147,60
Ozone Depletion Potential (ODP)	[kg R11-eqv.]	2,45E-04				-3,54E-05
Acidification Potential (AP)	[kg SO_2-eqv.]	38,56				-8,46
Eutrophication Potential (EP)	[kg PO_4-eqv.]	1,28				-0,69
Photochemical Ozone Creation Potential (POCP)	[kg C_2H_2-eqv.]	2,87				-0,62

* The data reference consisted of specific data provided by OUTOKUMPU and of data from the GaBi4 Database

02 Product

Product Description / Product characterisation

This EPD describes cold rolled stainless steel products produced by Outokumpu Oyj. Cold rolled products are supplied as coil, sheet or as plate. The cold rolled stainless steel has excellent dimensional tolerances and high surface quality. A number of sheet widths and heights are available to meet the various design specifications and requirements. A multitude of surface finishes are also available, including patterned, wet or dry polished. This EPD is applicable to homogeneous Outokumpu cold rolled products which are used in the construction and building industry.

Scope of validity / Applicability of the EPD

The applicability of the document is restricted to cold rolled stainless steel supplied by Outokumpu. The data have been provided by a representative mix of 5 manufacturing plants from all parts of Europe, based upon production during 2010.

Product standards

The products are produced in accordance with various national and/or international technical regulations applicable to relevant application.

In addition, the products are certified in accordance with product standards such as EN 10088, EN 10028-7, ASTM A240, ASME SA 240, JIS G4304.

Product Application

Cold rolled products are used in a wide range of applications in building and construction. Typical applications are building envelopes, interior cladding and panelling, heating, cooling and ventilation, lifts and elevators.

Delivery conditions

Cold rolled conditions, for example 2B, according to EN 10088-2 and certified in accordance with EN10204.

Technical Properties

Product characteristics according to relevant product standard: EN 10088, EN10028-7, ASTM A240, ASME IID, JIS G4304

More detailed information on technical properties in Outokumpu brochure "Steel Grades, Properties and Global Standards"

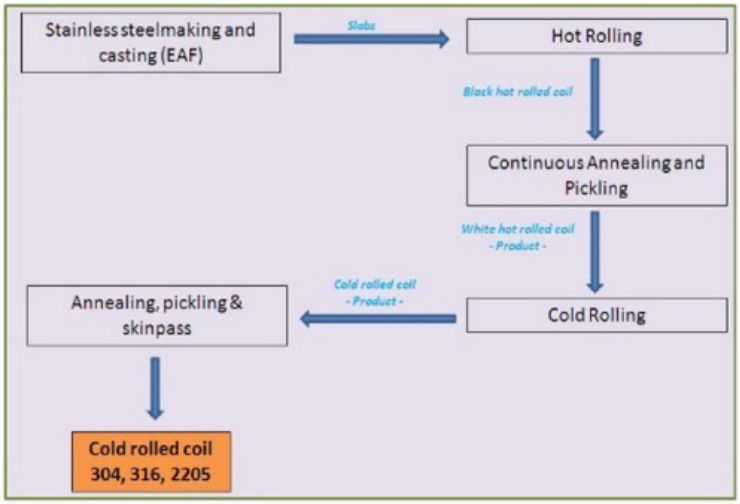
Density	7.7-8.1 kg/dm3
Modulus of elasticity E (RT)	190-220 GPa
Thermal expansion (RT to 100 C)	10-16.7 * 10-6 m/m° C
Thermal conductivity (RT)	12-30 W/ m° C

Declaration of Basic Materials

The manufacturing process uses ferrous scrap, mainly stainless as main raw material. Both alloyed and non-alloyed scrap is used. Alloying elements are also added as ferroalloys or metals. The most common alloying elements are chromium, nickel, molybdenum and manganese. Other elements like for example nitrogen, niobium, titanium, copper and silicon may also be present in the steel. The presence and rates of these alloying elements depend on the steel grade as set out in EN 10088-1. All stainless steels contain at least 10.5 % chromium.

Manufacturing Process

The steel scrap is melted in an electric arc furnace to obtain a steel melt. The liquid steel is further refined (adjustment of sulphur, carbon and phosphorus), and alloyed to give the requested characteristics to the steel. The molten steel is then cast into semi-finished steel products like slabs or billets. The semi-finished steel products are hot rolled and then annealed and pickled and cold rolled into desired thickness. If required, they can also be patterned rolled or polished.



Packaging

Stainless plates and coils are usually delivered with interleaving paper and/or a polyethylene plastic film to protect the surface.

Environment, Health and Safety during Production-Stage

Environmental and quality management in accordance with ISO 14001 and ISO 9001. Implementation of occupational health and safety management in accordance with OHSAS 18001 is ongoing.

Installation

Processing and installation of the steel coil, sheet or plate has to be carried out depending on the respective application according to the generally recognised rules of engineering and the manufacturer's recommendation.

Eurocode EC3 and EC4 apply to the design and construction. They include the requirements regarding performance, durability and fire resistance of steel structures.

During handling and use of the products, normal occupational safety measures should be applied. Instructions from the manufacturer concerning welding as well as hot and cold forming are to be followed.

Under normal conditions there will be no significant environmental impact to water, air or soil.

Residual material like steel scrap should be collected as it is 100% recyclable.

Use Stage

Service life in Use-Stage

Stainless steel is durable when the appropriate grade for the specific environment and application is chosen. No coating or painting is required for the performance of the material.

Maintenance in Use-Stage

The maintenance requirements depend on the specific design and application, but typically stainless steel only requires a minimum of maintenance. For example washing with mild detergents to maintain an esthetical appearance.

Environment, health and safety in Use-Stage

Under normal conditions of use, stainless steel products do not cause adverse health effects, and stainless steel does not release VOCs in indoor air

Similarly no significant environmental impact to water, air or soil is expected, due to the extremely low metal release from stainless steel and the low maintenance need.

End of Life

Deconstruction

To maximise the potential to re-use or recycle stainless steel, the design of the application should facilitate the disassembly at the end of its useful life.

Re-use

Stainless steel panels and structures can be re-used after recovery.

Recycling and Recovery

Stainless steel is 100% recyclable and keeps the same high quality when recycled. Recycling routes are well-established, and recycling is therefore the preferred disposal route

Landfill - Disposal

Stainless steel scrap is a valuable resource with well-established recycling routes. Disposal is not recommended, but has no adverse environmental impact.

EoL scenario

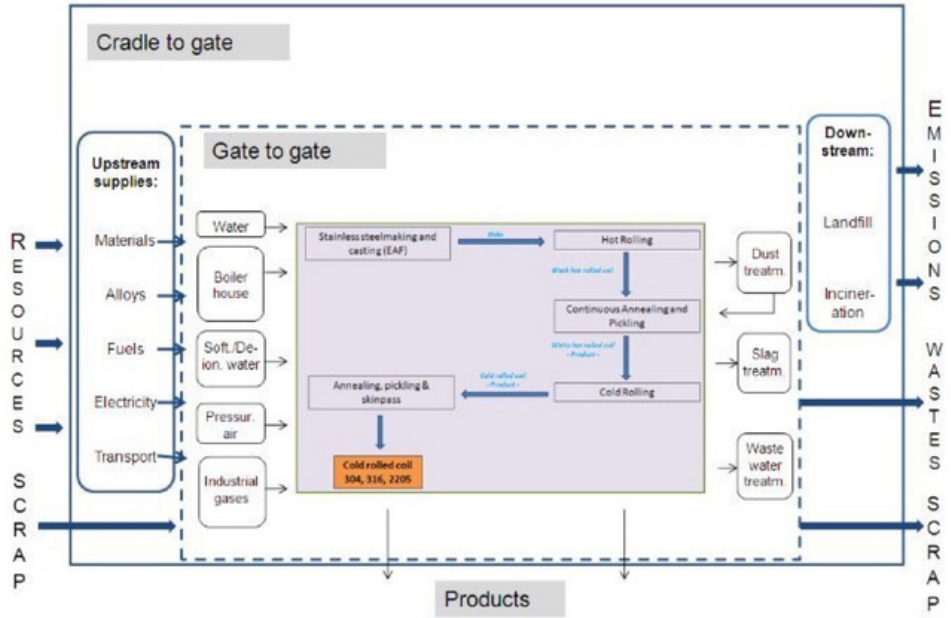
An average recycling rate of 85% is considered for construction and civil work– there are some construction products that will have a higher rate (e.g. in the main construction of the building above ground) and some that will have a lower rate (e.g. the foundations, etc). Within this EPD, an 85% recycling rate of construction stainless steel is assumed (including collection rate and recycling yield processes). Considering 60% of stainless steel scrap from post consumer sources is used as material input into the production process, the net quantity of stainless steel scrap credited is 25% (scrap recycled – scrap used).

03 LCA Description

Declared unit

This EPD applies to 1 ton stainless steel coil, sheet or plate.

System boundaries flow chart



A full life cycle assessment of products made from stainless steel should consider the product's expected service life, the ability to avoid material replacement when appropriate grades and finishes are selected, and the contribution of surface finish to building energy reduction.

Building assessment information (x = included in LCA)
(system boundaries check box)

Product Stage			Construction Process Stage		Use Stage							End-of-Life Stage				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to building site	Installation into building	Use / application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport	Waste processing	Disposal	Reuse, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X																X

The installation and demolition of the building, as well as the transport of the materials (stages A4; A5 and C respectively) were excluded from the analysis since their contributions on the overall results are expected to be minimal.

System Boundaries and Scenarios

The analysis of the product life cycle includes production of the basic materials, transport of the basic materials, manufacture of the product and the packaging materials and is declared in module A1-A3.

Waste treatment, gained energy from waste incineration and substitution of recovered materials inside the factories are also declared in module A (shown below under waste treatment and substitution).

The use stage is not taken into account in the LCA calculations. This needs to be considered on next level by the evaluation of buildings.

The end-of-life is also taken into account in the LCA calculations as described in the EoL scenario.

Data quality

For life cycle modelling of the considered products, the GaBi 4 Software System for Life Cycle Engineering and GaBi 4 database is used. All data used are less than 6 years old.

The annual quantities for 2010 have been provided by the manufacturers and used as primary data. Data is factory data for all products produced by Outokumpu. The data were collected under consistent methodological and boundary conditions.

Assumptions and Estimations

85% of metal components are assumed to be recycled at end of life (recycling rate). Due to 60% of stainless steel scrap content, the rest of 25% (85% - 60%) stainless steel scrap are counted and declared as credit in module D.

It means each 1000 kg of hot rolled coil produced, 200 kg stainless steel scrap is credited.

Cut-off criteria

All data from the production data acquisition are considered, i.e. all raw materials and main materials transport (such as alloys), water, thermal and electrical energy, packaging materials, and production waste. Thus, even minor material and energy flows of less than 1% mass are included. It can be assumed that the total sum of neglected processes per module A and D (for the sub-modules covered) does not exceed 5% of the impact categories.

Machines, facilities and infrastructure required during manufacture are not taken into account.

Allocation

Module A: In the calculation model of the production, waste (which has metal content) treated and energy (electrical or thermal) gained on site is considered as closed loop, and is given a credit by avoiding production of the same amount primary product, within module A.

04 LCA Results

Declared unit: 1 ton of cold rolled stainless steel

Table 2: resource categories

Resource input LCIA results										
Resource input parameters	Unit	Product Stage	Construction Process Stage		Use Stage	End-of-Life Stage				Benefits and loads beyond the system boundary
		Raw material supply, Manufacturing	Transport to building site	Installation into building	Use total	Deconstruction/ demolition	Transport to EoL	Waste processing	Disposal	Reuse, recovery or recycling potential
Primary Energy Demand from Renewable Resources	[MJ]	10.346,29								-1.081,12
Primary Energy Demand from Non-renewable Resources	[MJ]	44.618,46								-17.396,81
Water utilisation	[m^3]	74.529,77								-21.248,65
Non Renewable secondary fuels	[MJ]	0,00								0,00
Renewable secondary fuels	[MJ]	0,00								0,00
Secondary Material	[kg]	Post consumer: 550 kg Pre-consumer: 50kg	Module not assessed							0,00

Note: Feedstock energy and exported energy are 0

Table 3: waste categories

Emission output LCIA results										
Output flow/ Waste category	Unit	Product Stage	Construction Process Stage		Use Stage	End-of-Life Stage				Benefits and loads beyond the system boundary
		Raw material supply, Manufacturing	Transport to building site	Installation into building	Use total	Deconstruction/ demolition	Transport to EoL	Waste processing	Disposal	Reuse, recovery or recycling potential
Components for re-use	[kg]	0,00								0,00
Materials for recycling	[kg]	38,64								-3,18
										and ≈ 850 kg as Stainless steel recovered
Materials for energy recovery	[kg]	1,5E-03								-7,6E-04
Hazardous waste	[kg]	179,02								-95,72
Non hazardous waste	[kg]	12.834,79								-6.431,53
Radioactive waste	[kg]	3,06	Module not assessed							-0,44

Table 4: impact categories

Total environmental LCIA Results										
Environmental Parameters	Unit	Product Stage	Construction Process Stage		Use Stage	End-of-Life Stage				Benefits and loads beyond the system boundary
		Raw material supply, Manufacturing	Transport to building site	Installation into building	Use total	Deconstruction/ demolition	Transport to EoL	Waste processing	Disposal	Reuse, recovery or recycling potential
Abiotic Depletion (ADP elements)	[kg Sb eqv.]	0,11								-0,05
Abiotic Depletion (ADP fossil)	[MJ]	30.912,40								-13.870,12
Global Warming Potential (GWP 100 year)	[kg CO_2-eqv.]	3.005,96								-1.147,60
Ozone Depletion Potential (ODP)	[kg R11-eqv.]	2,45E-04								-3,54E-05
Acidification Potential (AP)	[kg SO_2-eqv.]	38,56								-8,46
Eutrophication Potential (EP)	[kg PO_4-eqv.]	1,28								-0,69
Photochemical Ozone Creation Potential (POCP)	[kg C_2H_4-eqv.]	2,87	Module not assessed							-0,62

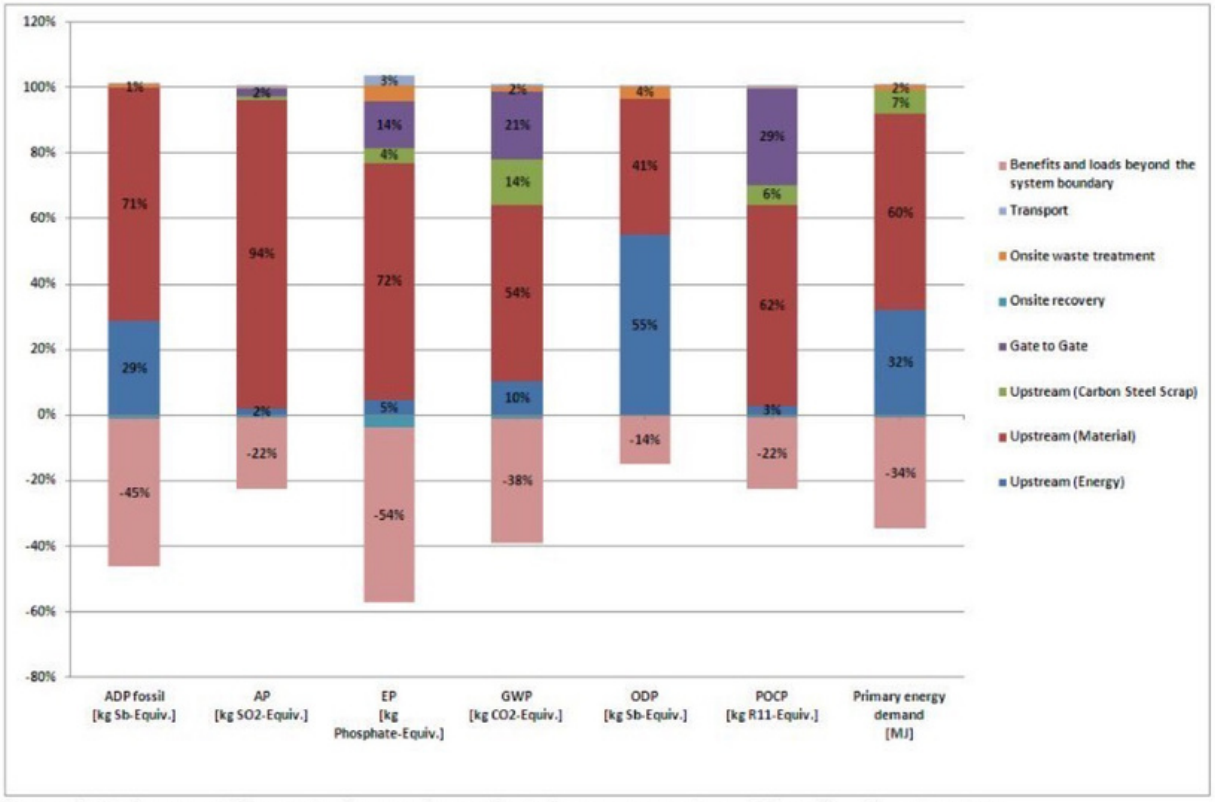


Figure 1: Environmental impacts shares of manufacturing components and benefits of next system

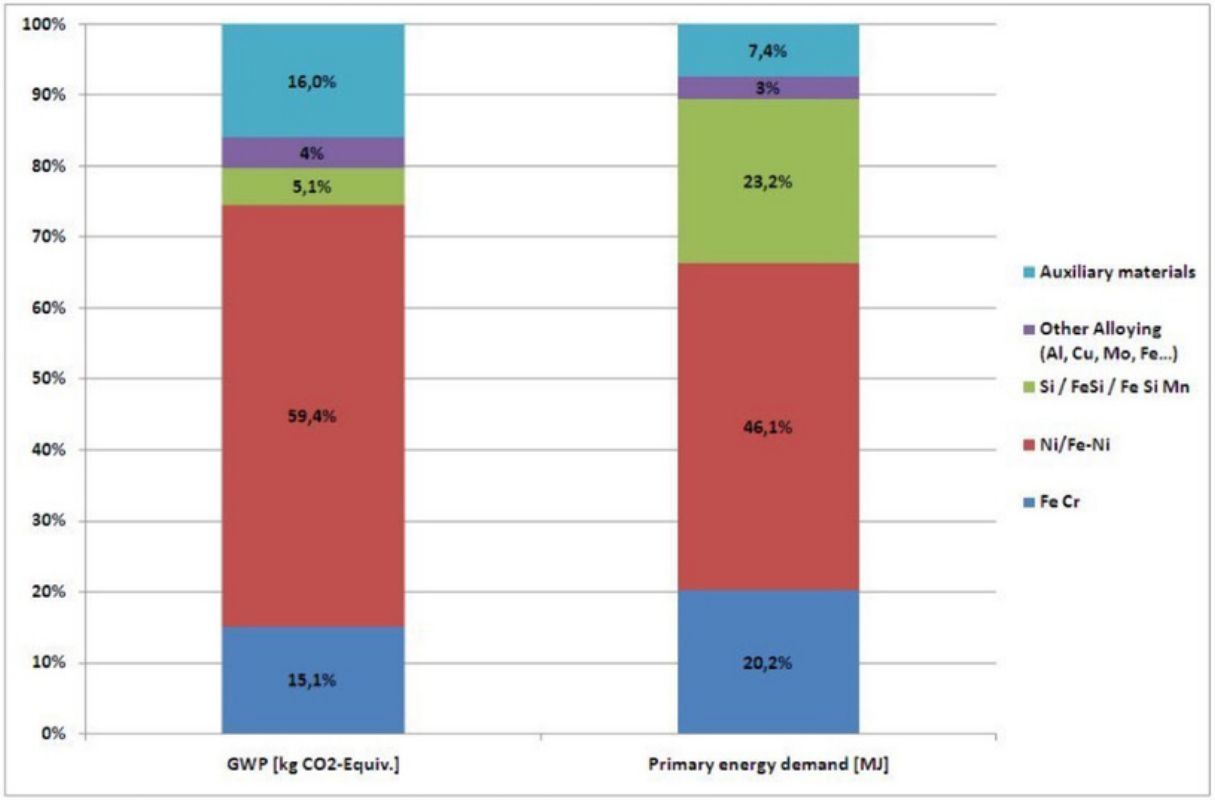


Figure 2: Impacts shares of alloying materials and auxiliary materials

GWP – global warming potential

The **global warming potential** is basically determined by the impact of the basic material production (54%), followed by the manufacturing processes (21%), carbon steel scrap upstream (14%), and supplied energy (10%).

250 kg of stainless steel scrap at end of life contributes a credit of -38% of the overall result. (Figure 1) – This credit corresponds to the benefit beyond the system boundaries.

On site waste treatment and credit given to valuable waste flows (recovery) don't have a strong influence in the overall result. (Figure 1)

Considering the pure production phase ("cradle-to-gate") of the products manufactured, the basic materials make up approximately 84% of GWP:

- 15% from FeCr
- 59% from Ni and FeNi
- 5% from Si and FeSi
- 4% from other metal alloying.

(Figure 2)

PED - primary energy demand

The primary energy demand arises primarily from the basic material production (60%), followed by the supplied energy (32 %). Carbon Steel Scrap is treated as a raw material which comes from another system with burdens (7%).

250 kg of stainless steel scrap at end of life contributes -34% of the overall result. (Figure 1) – This credit corresponds to the benefit beyond the system boundaries.

On site waste treatment and credit given to valuable waste flows (recovery) don't have a strong influence in the overall result. (Figure 1)

Considering the pure production phase ("cradle-to-gate") of the products manufactured, the basic materials make up approximately 92% of primary energy demand:

- 20% from FeCr
- 46% from Ni and FeNi
- 23% from Si and FeSi
- 3% from other metal alloying.

(Figure 2)

All impact categories

All categories are dominated by the influence of the basic material followed by energy consumption and carbon steel scrap upstream.

The credit which is given to stainless steel scrap contributes between 14-54% to all impact categories. This results in negative values in module D.

The Gate-to-gate system – which corresponds to processing itself – is most prevalent in the POCP category (29%), GWP category (almost 21%), and the EP category (14%) (Figure1)

Transportation has a low influence on all impact categories compared to the contributions from other areas.

The analysis of waste generation is done separately for the three fractions: hazardous waste, non-hazardous waste and radioactive waste. The major part of the non-hazardous waste is stockpile material from the upstream chain of input materials manufacture and from the supply of primary energy carriers for the generation of electrical energy.

References

/PCR Carbon and stainless steel in construction/	Institut Bauen und Umwelt e.V., Königswinter: Rules for Environmental Product Declarations, Carbon and stainless steel in construction, 2011-05
/EN 10088/	DIN EN 10088-1:2005-09: Stainless steels - Part 1: List of stainless steels
/EN10028-7/	DIN EN 10028-7:2008-02: Flat products made of steels for pressure purposes - Part 7: Stainless steels
/GaBi 4/	GaBi 4: Software and Database for Life Cycle Engineering, IKP [Institute for Polymer Testing and Polymer Science] University of Stuttgart and PE Europe GmbH, Leinfelden-Echterdingen, 1992 – 2010.
/ISO 14001/	ISO 14001:2009-11: Environmental management systems – Requirements with guidance for use
/ISO 14025/	DIN EN ISO 14025:2009-11: Environmental labels and declarations — Type III environmental declarations — Principles and procedures
/ISO 14040/	DIN EN ISO 14040:2009-11: Environmental management - Life cycle assessment - Principles and framework
/ISO 14044/	DIN EN ISO 14044:2006-10: Environmental management - Life cycle assessment - Requirements and guidelines
/ISO 9001/	DIN EN ISO 9001:2008-12: Quality management systems – Requirements

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ENVIRONMENTAL PRODUCT DECLARATION

According to ISO 14025

Declaration Holder	**Outokumpu Oyj**
Editor	Environmental Construction Products Organisation (ECO)
Porgram holder	Institut Bauen und Umwelt e.V.
Declaration number	ECO-OUT-00010101-1106
Date of issue	28.06.2011
Validity Date	27.06.2016

Hot Rolled Stainless Steel

Outokumpu Oyj

www.eco-europe.org

01 Summary

Outokumpu Hot Rolled Stainless Steel

Program holder

IBU - Institut Bauen und Umwelt e.V.

Rheinufer108

D-53639 Königswinter
Germany

Declaration number

ECO- OUT-00010101-1106

LCA Practitioner

PE INTERNATIONAL AG

This declaration is based on the PCR document:

Carbon and stainless steel in construction, 2011-05 (reviewed by IBU third party independent expert committee).

Date of issue

28.06.2011

Validity date

27.06.2014

Declaration holder

Outokumpu Oyj

Riihitontuntie 7
FI-02201 ESPOO

Finland

Declared product/Declared unit

This EPD applies to 1 ton of hot rolled stainless steel. It covers steel delivered as sheet or as plate for various applications for building and civil work.

Verification

Product Category Rules 'Carbon and stainless steel in construction' serves as guidance
Third party independent verification of the declaration, according to ISO 14025
☐ internal ☒ external

Hans Peters, CEO of IBU

Dr. Eva Schmincke, third party verifier

Declared unit: 1 ton of hot rolled stainless steel

Table 1: overview impact categories

Total LCIA Results						
Environmental Parameters	**Unit per ton**	**Product Stage**	*Construction Process Stage*	*Use Stage*	*End-of-Life Stage*	**Benefits and loads beyond the system boundary**
Primary Energy Demand from Renewable Resources	[MJ]	8.946,91	Module not assessed	Module not assessed	Module not assessed	-1.063,51
Primary Energy Demand from Non-renewable Resources	[MJ]	37.400,02				-15.184,83
Abiotic Depletion (ADP elements)	[kg Sb eqv.]	0,11				-0,15
Abiotic Depletion (ADP fossil)	[MJ]	25.218,16				-11.426,08
Global Warming Potential (GWP 100 year)	[kg CO_2-eqv.]	2.466,67				-999,48
Ozone Depletion Potential (ODP)	[kg R11-eqv.]	2,08E-04				-4,09E-05
Acidification Potential (AP)	[kg SO_2-eqv.]	32,43				-8,12
Eutrophication Potential (EP)	[kg PO_4-eqv.]	0,99				-0,55
Photochemical Ozone Creation Potential (POCP)	[kg C_2H_2-eqv.]	2,29				-0,57

* The data reference consisted of specific data provided by OUTOKUMPU and of data from the GaBi4 Database

02 Product

Product Description / Product characterisation

This EPD describes hot rolled stainless steel products produced by Outokumpu Oyj. Hot rolled products are supplied as coil or as plate. The hot rolled stainless steel has excellent durability and strength. A number of sheet and plate widths, lengths and thicknesses are available to meet the various design specifications and requirements. Several surface finishes are available, i.e., pickled, brushed and ground surface. This EPD is applicable to homogeneous Outokumpu hot rolled products which are used in the construction and building industry.

Scope of validity / Applicability of the EPD

The applicability of the document is restricted to hot rolled stainless steel supplied by Outokumpu. The data have been provided by a representative mix of 5 manufacturing plants from all parts of Europe, based upon production during 2010.

Product standards

The products are produced in accordance with various national and/or international technical regulations applicable to the relevant applications.

In addition, the products are certified in accordance with product standards such as EN 10088, EN 10028-7, ASTM A240, ASME SA 240, JIS G4304.

Product Application

Hot rolled products are used in a wide range of applications in building and construction. Typical applications are load bearing structures such as heavy transport, bridges and floodgates, building fixings, traffic barriers, and façade components.

Delivery conditions

Hot Rolled 1D and 1G condition according to EN 10 088 and in accordance with EN 10204.

Technical Properties

Product characteristics according to relevant product standard: EN 10088, EN10028-7, ASTM A240, ASME IID, JIS G4304

More detailed information on technical properties in Outokumpu brochure “Steel Grades, Properties and Global Standards”

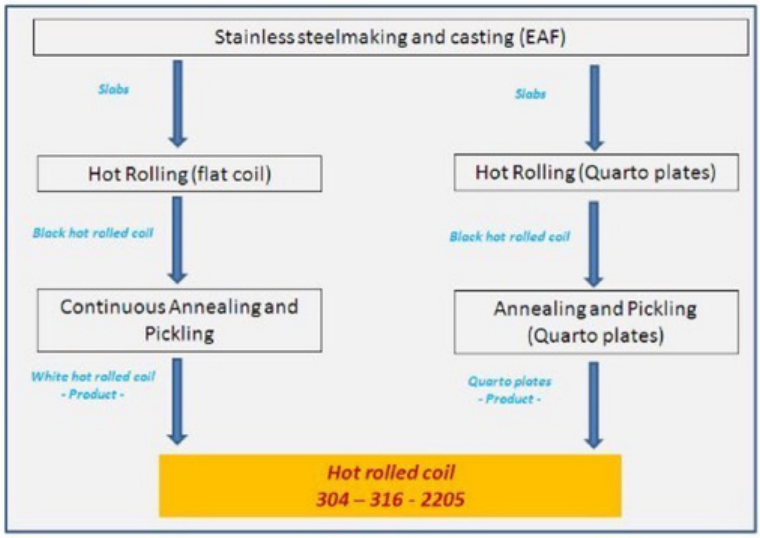
Density	7.7-8.1 kg/dm3
Modulus of elasticity E (RT)	190-220 GPa
Thermal expansion (RT to 100 C)	10-16.7 * 10-6 m/m° C
Thermal conductivity (RT)	12-30 W/ m° C

Declaration of Basic Materials

The manufacturing process uses ferrous scrap, mainly stainless as main raw material. Both alloyed and non-alloyed scrap is used. Alloying elements are also added as ferroalloys or metals. The most common alloying elements are chromium, nickel, molybdenum and manganese. Other elements like for example nitrogen, niobium, titanium, copper and silicon may also be present in the steel. The presence and rates of these alloying elements depend on the steel grade as set out in EN 10088-1. All stainless steels contain at least 10.5 % chromium.

Manufacturing Process

The steel scrap is melted in an electric arc furnace to obtain a steel melt. The liquid steel is further refined (adjustment of sulphur, carbon and phosphorus), and alloyed to provide the requested characteristics of the steel. The molten steel is then cast into semi-finished steel products like slabs or billets. The semi-finished steel products are hot rolled into desired thickness and then annealed and pickled.



Packaging

Stainless sheets and plates are usually delivered with paper to protect the surface.

Environment, Health and Safety during Production-Stage

Environmental and quality management in accordance with ISO 14001 and ISO 9001. Implementation of occupational health and safety management in accordance with OHSAS 18001 is ongoing.

Installation

Processing and installation of the steel coil, sheet or plate has to be carried out depending on the respective application according to the generally recognised rules of engineering and the manufacturer's recommendation.

Eurocode EC3 and EC4 apply to the design and construction. They include the requirements regarding performance, durability and fire resistance of steel structures.

During handling and use of the products, normal occupational safety measures should be applied. Instructions from the manufacturer concerning welding as well as hot and cold forming are to be followed.

Under normal conditions there will be no significant environmental impact to water, air or soil.

Residual material like steel scrap should be collected as it is 100% recyclable.

Use Stage

Service life in Use-Stage

Stainless steel is durable when the appropriate grade for the specific environment and application is chosen. No coating or painting is required for the performance of the material.

Maintenance in Use-Stage

The maintenance requirements depend on the specific design and application, but typically stainless steel only requires a minimum of maintenance. For example washing with mild detergents to maintain an esthetical appearance.

Environment, health and safety in Use-Stage

Under normal conditions of use, stainless steel products do not cause adverse health effects, and stainless steel does not release VOCs in indoor air

Similarly no significant environmental impact to water, air or soil is expected, due to the extremely low metal release from stainless steel and the low maintenance need.

End of Life

Deconstruction

To maximise the potential to re-use or recycle stainless steel, the design of the application should facilitate the disassembly at the end of its useful life.

Re-use

Stainless steel panels and structures can be re-used after recovery.

Recycling and Recovery

Stainless steel is 100% recyclable and keeps the same high quality when recycled. Recycling routes are well-established, and recycling is therefore the preferred disposal route.

Landfill - Disposal

Stainless steel scrap is a valuable resource with well-established recycling routes. Disposal is not recommended, but has no adverse environmental impact.

EoL scenario

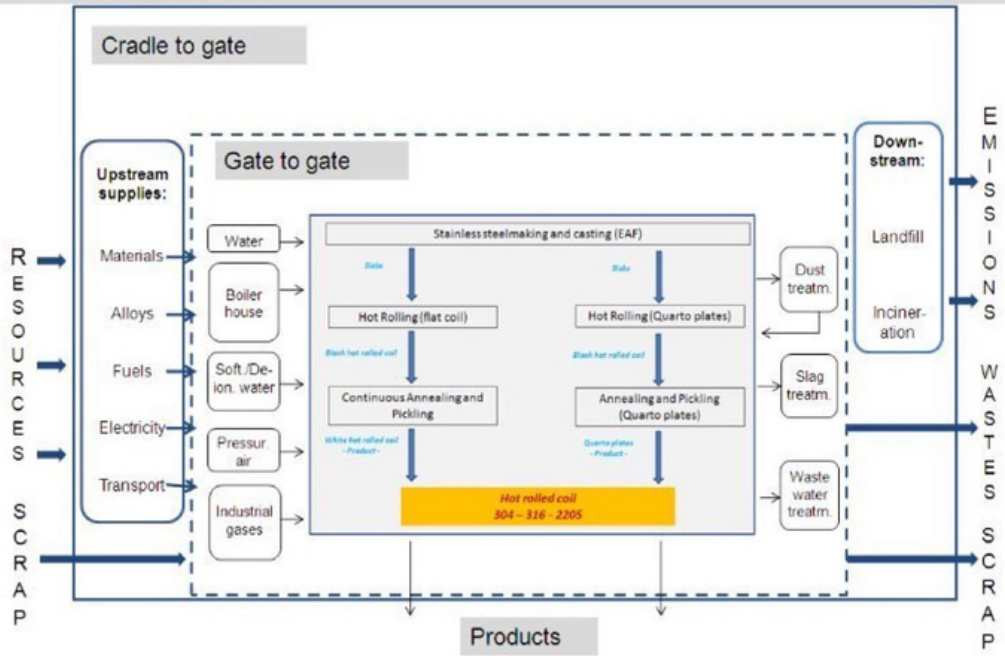
An average recycling rate of 85% is considered for construction and civil work– there are some construction products that will have a higher rate (e.g. in the main construction of the building above ground) and some that will have a lower rate (e.g. the foundations, etc). Within this EPD, an 85% recycling rate of construction stainless steel is assumed (including collection rate and recycling yield processes). Considering 60% of stainless steel scrap from post consumer sources is used as material input into the production process, the net quantity of stainless steel scrap credited is 25% (scrap recycled – scrap used).

03 LCA Description

Declared unit

This EPD applies to 1 ton stainless steel coil, sheet or plate.

System boundaries flow chart



A full life cycle assessment of products made from stainless steel should consider the product's expected service life, the ability to avoid material replacement when appropriate grades and finishes are selected, and the contribution of surface finish to building energy reduction.

Building assessment information (x = included in LCA)
(system boundaries check box)

Product Stage			Construction Process Stage		Use Stage							End-of-Life Stage				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to building site	Installation into building	Use / application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport	Waste processing	Disposal	Reuse, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X																X

The installation and demolition of the building, as well as the transport of the materials (stages A4; A5 and C respectively) were excluded from the analysis since their contributions on the overall results are expected to be minimal.

System Boundaries and Scenarios

The analysis of the product life cycle includes production of the basic materials, transport of the basic materials, manufacture of the product and the packaging materials and is declared in module A1-A3.

Waste treatment, gained energy from waste incineration and substitution of recovered materials inside the factories are also declared in module A (shown below under waste treatment and substitution).

The use stage is not taken into account in the LCA calculations. This needs to be considered on next level by the evaluation of buildings.

The end-of-life is also taken into account in the LCA calculations as described in the EoL scenario.

Data quality

For life cycle modelling of the considered products, the GaBi 4 Software System for Life Cycle Engineering and GaBi 4 database is used. All data used are less than 6 years old.

The annual quantities for 2010 have been provided by the manufacturers and used as primary data. Data is measured factory data for all products produced by Outokumpu. The data were collected under consistent methodological and boundary conditions.

Assumptions and Estimations

85% of metal components are assumed to be recycled at end of life (recycling rate). Due to 60% of stainless steel scrap content, the rest of 25% (85% - 60%) stainless steel scrap are counted and declared as credit in module D.

It means each 1000 kg of hot rolled coil produced, 200 kg stainless steel scrap is credited.

Cut-off criteria

All data from the production data acquisition are considered, i.e. all raw materials and main materials transport (such as alloys), water, thermal and electrical energy, packaging materials, and production waste. Thus, even minor material and energy flows of less than 1% mass are included. It can be assumed that the total sum of neglected processes per module A and D (for the sub-modules covered) does not exceed 5% of the impact categories.

Machines, facilities and infrastructure required during manufacture are not taken into account.

Allocation

Module A: In the calculation model of the production, waste (which has metal content) treated and energy (electrical or thermal) gained on site is considered as closed loop, and is given a credit by avoiding production of the same amount primary product, within module A.

04 LCA Results

Declared unit: 1 ton of hot rolled stainless steel

Table 2: resource categories

Resource input LCIA results										
Resource input parameters	Unit	Product Stage	Construction Process Stage		Use Stage	End-of-Life Stage				Benefits and loads beyond the system boundary
		Raw material supply, Manufacturing	Transport to building site	Installation into building	Use total	Deconstruction/ demolition	Transport to EoL	Waste processing	Disposal	Reuse, recovery or recycling potential
Primary Energy Demand from Renewable Resources	[MJ]	8.946,91								-1.063,51
Primary Energy Demand from Non-renewable Resources	[MJ]	37.400,02								-15.184,83
Water utilisation	[m^3]	55.834,21								-19.336,33
Non Renewable secondary fuels	[MJ]	0,00								0,00
Renewable secondary fuels	[MJ]	0,00								0,00
Secondary Material	[kg]	Post consumer: 450 kg Pre-consumer: 150kg	Module not assessed							0,00

Note: Feedstock energy and exported energy are 0

Table 3: waste categories

Emission output LCIA results										
Output flow/ Waste category	Unit	Product Stage	Construction Process Stage		Use Stage	End-of-Life Stage				Benefits and loads beyond the system boundary
		Raw material supply, Manufacturing	Transport to building site	Installation into building	Use total	Deconstruction/ demolition	Transport to EoL	Waste processing	Disposal	Reuse, recovery or recycling potential
Components for re-use	[kg]	0,00								0,00
Materials for recycling	[kg]	52,39								-4,02
										and ≈ 850 kg as Stainless steel recovered
Materials for energy recovery	[kg]	1,6E-03								-2,4E-03
Hazardous waste	[kg]	167,68								-116,47
Non hazardous waste	[kg]	11.123,69								-8.014,81
Radioactive waste	[kg]	2,61	Module not assessed							-0,51

Table 4: impact categories

Total environmental LCIA Results										
Environmental Parameters	Unit	Product Stage	Construction Process Stage		Use Stage	End-of-Life Stage				Benefits and loads beyond the system boundary
		Raw material supply, Manufacturing	Transport to building site	Installation into building	Use total	Deconstruction/ demolition	Transport to EoL	Waste processing	Disposal	Reuse, recovery or recycling potential
Abiotic Depletion (ADP elements)	[kg Sb eqv.]	0,11								-0,15
Abiotic Depletion (ADP fossil)	[MJ]	25.218,16								-11.426,08
Global Warming Potential (GWP 100 year)	[kg CO_2-eqv.]	2.466,67								-999,48
Ozone Depletion Potential (ODP)	[kg R11-eqv.]	2,08E-04								-4,09E-05
Acidification Potential (AP)	[kg SO_2-eqv.]	32,43								-8,12
Eutrophication Potential (EP)	[kg PO_4-eqv.]	0,99								-0,55
Photochemical Ozone Creation Potential (POCP)	[kg C_2H_4-eqv.]	2,29	Module not assessed							-0,57

LCA results interpretation

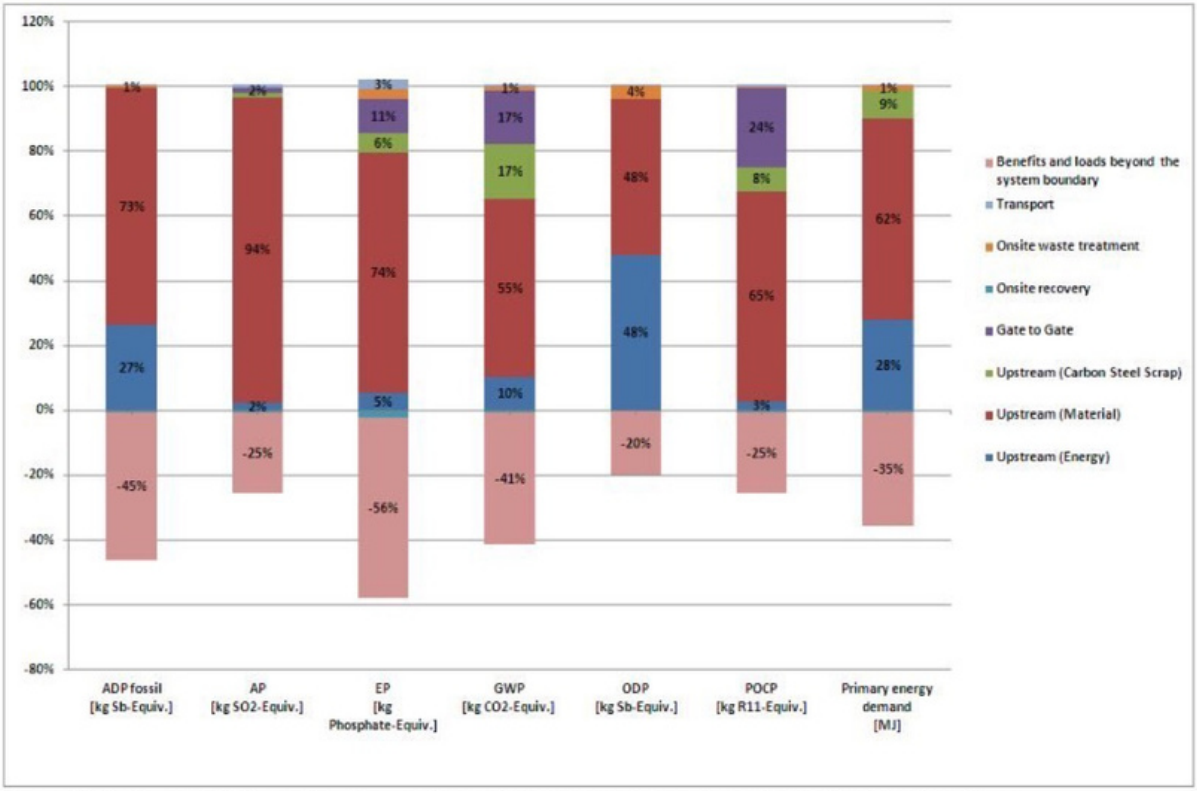


Figure 1: Environmental impacts shares of manufacturing components and benefits of next system

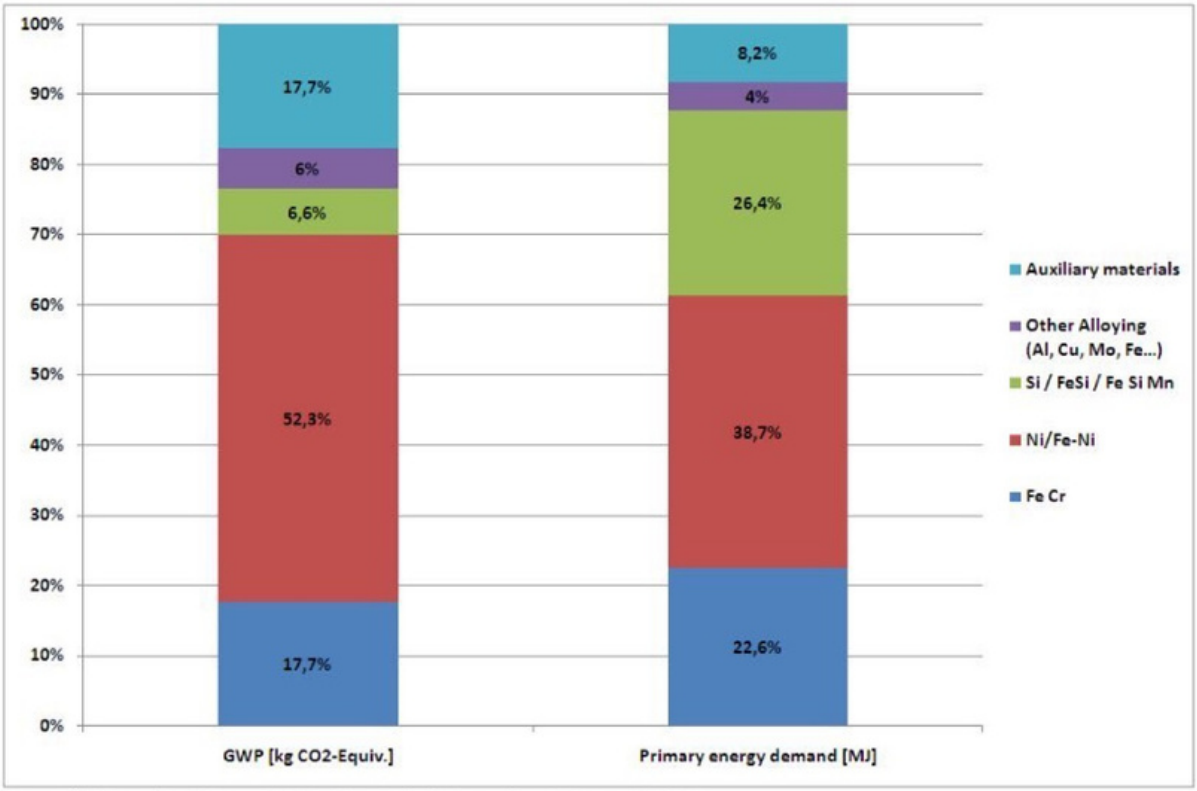


Figure 2: Impacts shares of alloying materials and auxiliary materials

GWP – global warming potential

The **global warming potential** is basically determined by the impact of the basic material production (55%), followed by the carbon steel scrap upstream (17%), manufacturing processes (17%) and supplied energy (10%).

250 kg of stainless steel scrap at end of life contributes a credit of -41% of the overall result. (Figure 1) – This credit corresponds to the benefit beyond the system boundaries.

On site waste treatment and credit given to valuable waste flows (recovery) don't have a strong influence in the overall result. (Figure 1)

Considering the pure production phase ("cradle-to-gate") of the products manufactured, the basic materials make up approximately 82% of GWP:

- 18% from FeCr
- 52% from Ni and FeNi
- 7% from Si and FeSi
- 6% from other metal alloying.

(Figure 2)

PED - primary energy demand

The **primary energy demand** arises primarily from the basic material production (62%), followed by the supplied energy (28 %). Carbon Steel Scrap is treated as a raw material which comes from another system with burdens (9%).

250 kg of stainless steel scrap at end of life contributes -35% of the overall result. (Figure 1) – This credit corresponds to the benefit beyond the system boundaries.

On site waste treatment and credit given to valuable waste flows (recovery) don't have a strong influence in the overall result. (Figure 1)

Considering the pure production phase ("cradle-to-gate") of the products manufactured, the basic materials make up approximately 92% of primary energy demand:

- 23% from FeCr
- 39% from Ni and FeNi
- 26% from Si and FeSi
- 4% from other metal alloying.

(Figure 2)

References

/PCR Carbon and stainless steel in construction/	Institut Bauen und Umwelt e.V., Königswinter: Rules for Environmental Product Declarations, Carbon and stainless steel in construction, 2011-05
/EN 10088/	DIN EN 10088-1:2005-09: Stainless steels - Part 1: List of stainless steels
/EN10028-7/	DIN EN 10028-7:2008-02: Flat products made of steels for pressure purposes - Part 7: Stainless steels
/GaBi 4/	GaBi 4: Software and Database for Life Cycle Engineering, IKP [Institute for Polymer Testing and Polymer Science] University of Stuttgart and PE Europe GmbH, Leinfelden-Echterdingen, 1992 – 2010.
/ISO 14001/	ISO 14001:2009-11: Environmental management systems – Requirements with guidance for use
/ISO 14025/	DIN EN ISO 14025:2009-11: Environmental labels and declarations — Type III environmental declarations — Principles and procedures
/ISO 14040/	DIN EN ISO 14040:2009-11: Environmental management - Life cycle assessment - Principles and framework
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/ISO 9001/	DIN EN ISO 9001:2008-12: Quality management systems – Requirements

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ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

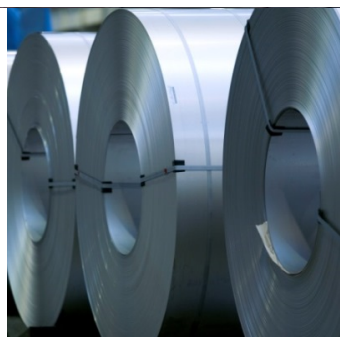
Owner of the Declaration	**Outokumpu Oyj**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-OTO-20190002-IBD1-EN
Issue date	28/06/2019
Valid to	27/06/2024

Cold Rolled Stainless Steel

Outokumpu Oyj

Institut Bauen und Umwelt e.V.

www.ibu-epd.com / https://epd-online.com



1. General Information

Outokumpu	Cold Rolled Stainless Steel
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the declaration** Outokumpu Oyj Salmisaarenranta 11 FI-00181 Helsinki Finland
Declaration number EPD-OTO-20190002-IBD1-EN	**Declared product / declared unit** This EPD applies to 1 ton of cold rolled stainless steel product. It covers steel delivered as sheet or as plate for various applications for building and civil work.
This declaration is based on the product category rules: Structural steels, 07.2014 (PCR checked and approved by the SVR)	**Scope:** The declaration applies to 1 ton of cold rolled stainless steel product produced by Outokumpu. The Life Cycle Assessment is based on data from the following Outokumpu production plants: - Outokumpu Nirosta GmbH, Dillenburg, Germany - Outokumpu Nirosta GmbH, Krefeld, Germany - Outokumpu Stainless AB, Avesta, Sweden - Outokumpu Stainless AB, Nyby, Torshalla, Sweden - Outokumpu Stainless Oy, Tornio, Finland - Outokumpu Stainless USA LLC, Calvert, AL, USA - Outokumpu Mexinox S.A de C.V., San Luis Potosi, Mexico Production has been modeled using annual production data from 2017. Where required averaging is based on production output from each site. The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.
Issue date 28/06/2019	
Valid to 27/06/2024	
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	**Verification** The standard /EN 15804/ serves as the core PCR Independent verification of the declaration and data according to /ISO 14025:2010/ ☐ internally ☒ externally
Dr. Alexander Röder (Head of Board IBU)	Dr.-Ing. Andreas Ciroth (Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition

This EPD describes cold rolled stainless steel products produced by Outokumpu Oyj. Cold rolled products are supplied as coil, sheet or plate. Cold rolled stainless steel has excellent dimensional tolerances and high surface quality. A number of sheet widths and heights are available to meet the various design specifications and requirements. A multitude of surface finishes are also available, including patterned, wet or dry polished. This EPD is applicable to homogeneous Outokumpu cold rolled products which are used in the construction and building industry.

For the placing on the market of the product in the EU/EFTA (with the exception of Switzerland) Regulation (EU) No. 305/2011 (CPR) applies. The product needs a declaration of performance taking into consideration /EN 10088-4:2009, Stainless steels. Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes/, /Limiting dimension and shape tolerance: Tolerances according to ISO (EN) 9444-2/ 9445-2/ and the CE-marking. For the application and use the respective national provisions apply.

2.2 Application

Cold rolled products are used in a wide range of applications in building and construction. Typical applications are building envelopes, interior cladding

and paneling, heating, cooling and ventilation, lifts and elevators.

2.3 Technical Data

Constructional data

Name	Value	Unit
Density	7900	kg/m^3
Coefficient of thermal expansion	14	$10^{-6}K^{-1}$
Thermal conductivity	19	W/(mK)
Modulus of elasticity	205	GPa
Melting point	1450	°C
Proof strength Rp0.2	200-530	MPa
Tensile strength Rm	420-950	MPa
Elongation A	18-45	%
Weldability	covered by chemical composition	
Durability	covered by chemical composition	
Cold formability	covered by elongation	

performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to /EN 10088-1:2014/, /EN 10028-7:2016/, /ASTM A240/, /ASME IID 2017/, /EN 10204:2005/, (not part of CE-marking).

2.4 Delivery status

Delivered with a standard cold rolled finishing condition, (e.g. 2B) according to /**EN 10088-1**/ and in accordance with /**EN 10204**/. The dimensions of the declared product may vary according to the final use.

The products are certified in accordance with product standards :
/EN 10088-1/
/EN 10028-7/
/ASTM A240/
/ASME IID/
/EN 10204/

2.5 Base materials / Ancillary materials

Manufacturing is based on recycling and ferrous scrap (predominantly stainless steel scrap) is used as a major raw material. Alloying elements are also added as ferroalloys or metals. The most common alloying elements are chromium, nickel, molybdenum, manganese and silicon. Other elements, for example nitrogen, niobium and titanium may also be present in the stainless steel. The presence and rates of these alloying elements depend on the stainless steel designation as set out in /**EN 10088-1**/. All stainless steels contain at least 10.5 % chromium.
Substances listed on the “Candidate List of Substances of Very High Concern for Authorisation” by the European Chemicals Agency are not contained in stainless steel in declarable quantities.

2.6 Manufacture

The steel scrap is melted in an electric arc furnace to obtain a steel melt. The liquid steel is further refined (adjustment of sulphur, carbon and phosphorous) and alloyed to give stainless steel the required characteristics. The molten steel is then cast into semi-finished steel products like slabs or billets. The semi-finished steel products are hot rolled and then annealed and pickled and cold rolled to a desired thickness. If required, they can also be pattern rolled or polished.

2.7 Environment and health during manufacturing

Environmental, occupational health and safety and quality management are in accordance with /**ISO 14001**/, /**ISO 9001**/ and /**OHSAS 18001**/.

2.8 Product processing/Installation

Processing and installation of the steel coil, sheet or plate has to be carried out according to generally recognized engineering rules and the manufacturer’s recommendation depending on the respective application.
Eurocodes /**EC3**/ and /**EC4**/ apply to the design and construction. They include the requirements regarding performance, durability and fire resistance of steel structures. During handling and use of the products, normal occupational safety measures should be applied. Instructions from the manufacturer concerning welding as well as cold forming are to be followed.
Under normal conditions no significant environmental impact to water, air or soil is known.
Residual material like steel scrap should be collected as it is 100% recyclable.

2.9 Packaging

Stainless coils and plates are usually delivered with interleaving paper and/or a polyethylene plastic film to protect the surface. This paper/plastic has been included in the EPD. In some cases, wooden pallets may be used for truck transport, although these have not been included in the EPD.

2.10 Condition of use

The maintenance requirements depend on the specific design and application, but typically stainless steel only requires a minimum of maintenance, for example, washing with mild detergents to maintain the product’s appearance.

2.11 Environment and health during use

Under normal conditions of use, no adverse health effects are known for stainless steel products.
Stainless steel does not release volatile organic compounds (VOCs) to indoor air.
Similarly no significant environmental impact to water, air or soil is expected, due to the extremely low metal release from stainless steel and the low maintenance need.

2.12 Reference service life

Service life is dependent upon physical and mechanical service conditions. Correct alloy designation choice can satisfy a required service life.

2.13 Extraordinary effects

Fire
Structural steel products meet the requirements of building material safety class A1 (i.e. non-flammable according to /**EN 13501-1**/).

Water
In the event of unforeseeable exposure to water caused by sudden flooding, no risks to the environment or human health are expected to occur.

Mechanical destruction
In the event of mechanical destruction, no risks to the environment or human health are expected to occur.

2.14 Re-use phase
Stainless steel structures are not generally reused at end-of-life. Reuse is possible and could take place providing that the reused component was able to meet the technical specifications required. Stainless steel is usually recycled and can be recycled to the same quality of steel without loss of properties.

2.15 Disposal
Stainless steel scrap is a valuable resource with well-established recycling routes. Disposal is not recommended, but no adverse environmental impact is known.
The /**European Waste Catalogue**/ code for iron and steel products is 17 04 05.

2.16 Further information
For further information on these products please refer to http://www.outokumpu.com.

3. LCA: Calculation rules

3.1 Declared Unit
The declaration applies to one ton of cold rolled stainless steel product. The declared unit is the production and recycling of one ton of cold rolled stainless steel product.

Declared unit

Name	Value	Unit
Declared unit	1000	kg

3.2 System boundary
This EPD is cradle-to-gate with options, and includes the following process steps:

- Upstream production of raw materials, fuels and energy and all relevant upstream transport processes.
- Production/manufacturing of the stainless steel product.
- Waste water and treatment of wastes generated on site including swarf, dusts, scrap, slag and waste water.
- End-of-life (recycling, remelting or disposal of steel scrap).

3.3 Estimates and assumptions
95 % of cold rolled structural steel products are assumed to be recycled at end-of-life. The average cold rolled product produced by Outokumpu has a stainless steel scrap content of 65.2 % hence the net stainless steel scrap output is 29.8 % (95 % - 65.8 %). This stainless steel scrap is declared as a credit in module D. This means that for each 1000 kg of cold rolled stainless steel product produced, 297.8 kg stainless steel scrap is credited.
The carbon steel scrap used as input is not included in these numbers as carbon steel scrap is considered an open loop with own burden.

End-of-Life Scenario
At end-of-life, a 95 % recycling rate for the steel product is assumed. The remaining 5 % is assumed to remain uncollected or to go to disposal e.g. landfill.

3.4 Cut-off criteria
All reported data were incorporated and modelled i.e. all raw materials, water, thermal and electrical energy and production waste.
The principal material transport processes (such as alloys and scrap) are also considered. Thus, even minor material and energy flows of less than 1 % mass are included.
Data for the sites were cross-checked with one another to identify potential data gaps. No processes, materials or emissions that are known to make a significant contribution to the environmental impact of the products studied have been omitted.
It can be assumed, that all excluded flows contribute less than 5% to the impact assessment categories.
Packaging materials and its transportation are neglected due to low contribution to the overall life cycle results.
Machines, facilities and infrastructure required during manufacture are not taken into account.

3.5 Background data
Background data for upstream materials, fuels and energy production are taken from the /**GaBi Database**/.

3.6 Data quality
Production has been modeled using 2017 average production data provided by Outokumpu's own sites and has been quality-checked by Outokumpu and thinkstep.

3.7 Period under review
Modelling is based on production data from 2017. Background data used are from the 2018 version of /**GaBi Database**/. Documentation related to all the processes used in the stainless steel production model can be found in the GaBi documentation /**GaBi Documentation**/.

3.8 Allocation
Slag generated as a by-product of electric arc furnace (EAF) steelmaking is used as an input to a variety of industries including as a constituent of cement, in road building or as fill material.

This study has adopted a conservative approach and has assumed that all the environmental burdens associated with the production of stainless steel products and EAF slag are allocated to the production of steel, with slag included under the material for recycling (MFR) category.

Production losses of steel during the production process are recycled in a closed loop reducing the requirement for external scrap.

Specific information on allocation within the background data is given in the GaBi datasets documentation (/**GaBi Documentation/)**.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

4. LCA: Scenarios and additional technical information

For this steel product folling average end of life scenarios were considered with the corresponding benefits and burdens:
Landfilling of 5%, a recycling rate of 95%.
The stainless steel scrap input into Modul A is 652 kg; this results in a value of scrap benefit of 297,8kg.

End of life (C3)

Name	Value	Unit
Landfilling	5	%

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
End-of-life recycling rate	95	%
Stainless steel scrap input (into module A)	65.2	%
Net stainless steel scrap credit	29.8	%
Equiv. Mass of stainless steel scrap credited per ton product	297.8	kg

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 t Cold Rolled Stainless Steel

Parameter	Unit	A1-A3	C3	D
Global warming potential	[kg CO_2-Eq.]	3.39E+3	2.48E+0	-1.50E+3
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	4.87E-9	7.00E-12	-1.16E-12
Acidification potential of land and water	[kg SO_2-Eq.]	1.66E+1	9.61E-3	-9.44E+0
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	1.16E+0	1.19E-3	-5.22E-1
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	1.11E+0	6.99E-4	-5.64E-1
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	1.89E-1	1.14E-6	-8.23E-2
Abiotic depletion potential for fossil resources	[MJ]	5.03E+4	2.87E+1	-1.80E+4

RESULTS OF THE LCA - RESOURCE USE: 1 t Cold Rolled Stainless Steel

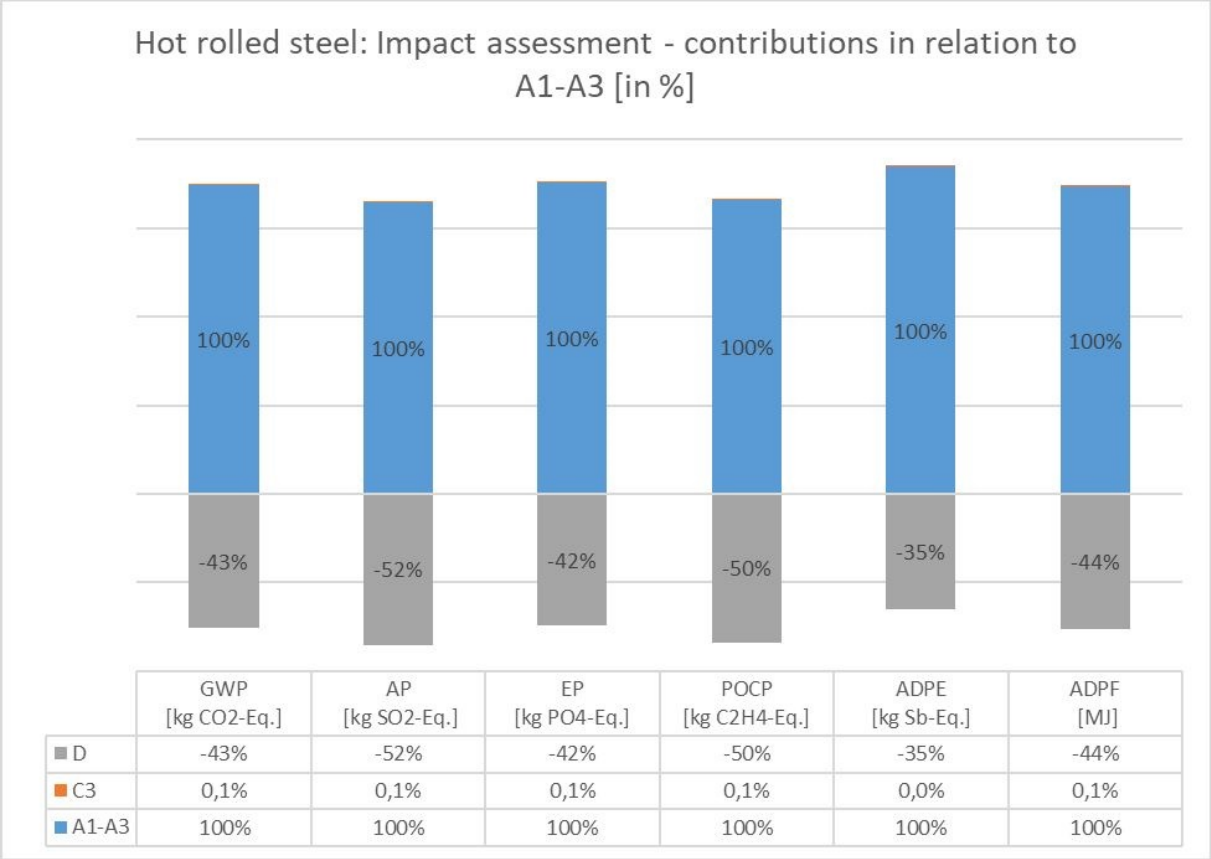
Parameter	Unit	A1-A3	C3	D
Renewable primary energy as energy carrier	[MJ]	8.79E+3	1.20E+1	-2.87E+3
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	8.79E+3	1.20E+1	-2.87E+3
Non-renewable primary energy as energy carrier	[MJ]	5.59E+4	4.07E+1	-1.83E+4
Non-renewable primary energy as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	5.59E+4	4.07E+1	-1.83E+4
Use of secondary material	[kg]	6.52E+2	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	3.82E+1	1.65E-2	-2.10E+1

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 t Cold Rolled Stainless Steel

Parameter	Unit	A1-A3	C3	D
Hazardous waste disposed	[kg]	4.86E-2	3.28E-7	-1.89E-1
Non-hazardous waste disposed	[kg]	3.41E+2	5.01E+1	1.99E+1
Radioactive waste disposed	[kg]	2.31E+0	4.80E-3	-1.54E-1
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	9.50E+2	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0

6. LCA: Interpretation

This chapter contains an interpretation of the Life Cycle Impact Assessment categories with regards to the functional unit – 1 ton of stainless steel product. It focuses on the dominant contributions during the production process and recycling steel at its end of life.



	GWP [kg CO2-Eq.]	AP [kg SO2-Eq.]	EP [kg PO4-Eq.]	POCP [kg C2H4-Eq.]	ADPE [kg Sb-Eq.]	ADPF [MJ]
D	-43%	-52%	-42%	-50%	-35%	-44%
C3	0,1%	0,1%	0,1%	0,1%	0,0%	0,1%
A1-A3	100%	100%	100%	100%	100%	100%

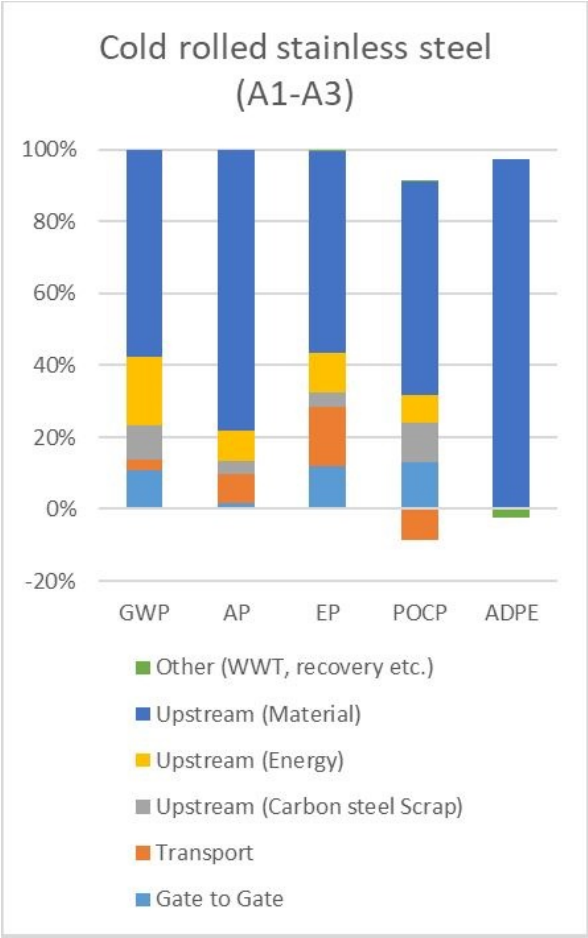
The figure above shows the relative contribution of the production stages (Module A1-A3), waste treatment (Module C3) and the benefits and loads beyond the product system boundary (Module D).
For all categories, the results for product stage (A1-3) contributes with the highest shares. Overall, C3 has a minimized contribution. The credits in Module D have a considerable share, thanks to the recycling.

The most relevant emissions on stainless steel production:
for **Global Warming Potential (GWP**) are CO2, CH4
for **Acidication Potential** (**AP)** are SO2 and NOx;
for **Eutrophication Potential (EP**) are NOx
for **Photochemical Ozone Creation Potential (POCP)** are CO, SO2, NOx, and NMVOC.

The main contribution to A1-A3 is the production of upstream materials, which is dominated by the production of the Fe-alloys Fe-Cr, Fe-Ni, Fe-Si, and Fe-Mo. The production of the listed Fe-alloys is high in energy consumption on Primary Energy Demand and registers high emissions of carbon dioxide, nitrogen oxides and sulphur dioxide with the resulting effect on Global Warming Potential, Acidification Potential, Eutrophication Potential and Photochemical Ozone Creation Potential.

In addition to the upstream material production, a certain influence on the overall results is given by the upstream energy production related to the electricity and fuel consumption on-site. Depending on the location of the site this influence might vary related to the country specific energy supply.

The following figure summarises percentage contributions to selected impact category for each of the products (cradle-to-gate), showing the large contribution from upstream materials.



7. Requisite evidence

This EPD covers cold rolled products which are likely to be employed in a variety of applications including building envelopes, interior cladding and paneling, heating, cooling and ventilation, lifts and elevators, many of which will require further processing and fabrication related to the final application. Consequently, further documentation is not applicable.

7.1 Weathering performance

The majority of the applications described in section 2.2 relate to the interior of buildings. However, where cold rolled stainless steel is used in an external application, no corrosion shall occur as stainless steel is inherently non-corrosive. For this reason, stainless steel products are often applied where corrosion resistance is a key performance characteristic such as marine environments.

8. References

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/EN 10028-7/
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/GaBi Documentation/
GaBi ts Documentation GaBi ts: Documentation of the GaBi datasets for Life Cycle Engineering. IABP, University of Stuttgart und thinkstep AG, 2018.
http://www.gabi-software.com/international/support/gabi/

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Web **www.outokumpu.com**

ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

Owner of the Declaration	**Outokumpu Oyj**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-OTO-20190003-IBD1-EN
Issue date	28.06.2019
Valid to	27.06.2024

Hot Rolled Stainless Steel

Outokumpu Oyj

Institut Bauen und Umwelt e.V.

www.ibu-epd.com / https://epd-online.com

1. General Information

Outokumpu Oyj	Hot Rolled Stainless Steel
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the declaration** Outokumpu Oyj Salmisaarenranta 11 FI-00181 Helsinki Finland
Declaration number EPD-OTO-20190003-IBD1-EN	**Declared product / declared unit** This EPD applies to 1 ton of hot rolled stainless steel product. It covers steel delivered as sheet or as plate for various applications for building and civil work.
This declaration is based on the product category rules: Structural steels, 07.2014 (PCR checked and approved by the SVR)	**Scope:** The declaration applies to 1 ton of hot rolled stainless steel product produced by Outokumpu. The Life Cycle Assessment is based on data from the following Outokumpu production plants: - Outokumpu Stainless AB, Avesta, Sweden - Outokumpu Stainless AB, Degerfors, Sweden - Outokumpu Stainless AB, Nyby, Torshalla, Sweden - Outokumpu Stainless Oy, Tornio, Finland - Outokumpu Nirosta GmbH, Dillenburg, Germany - Outokumpu Nirosta GmbH, Krefeld, Germany - Outokumpu Stainless USA LLC, Calvert, AL, USA Production has been modeled using annual production data from 2017. Where required averaging is based on production output from each site. The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.
Issue date 28.06.2019	
Valid to 27.06.2024	
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	**Verification** The standard /EN 15804/ serves as the core PCR Independent verification of the declaration and data according to /ISO 14025:2010/ ☐ internally ☒ externally
Dr. Alexander Röder (Head of Board IBU)	Dr.-Ing. Andreas Ciroth (Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition

This EPD describes hot rolled stainless steel products produced by Outokumpu Oyj. Hot rolled products are supplied as coil or as plate. Hot rolled stainless steel has excellent durability and strength. A number of sheet and plate widths, lengths and thicknesses are available to meet the various design specifications and requirements. Several surface finishes are available, e.g. pickled, brushed and ground surface. This EPD is applicable to homogeneous Outokumpu hot rolled products which are used in the construction and building industry.

For the placing on the market of the product in the EU/EFTA (with the exception of Switzerland) Regulation (EU) No. 305/2011 (CPR) applies. The product needs a declaration of performance taking into consideration/EN 10088-4:2009/, Stainless steels. Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes/, /Limiting dimension and shape tolerance: Tolerances according to ISO (EN) 9444-2/ 9445-2/, /EN 10029/ and the CE-marking. For the application and use the respective national provisions apply.

2.2 Application

Hot rolled products are used in a wide range of applications in building and construction. Typical applications are load bearing structures such as heavy transport, bridges and floodgates, building fixings, traffic barriers, and façade components.

2.3 Technical Data

Constructional data

Name	Value	Unit
Density	7900	kg/m^3
Coefficient of thermal expansion	14	$10^{-6}K^{-1}$
Thermal conductivity	19	W/(mK)
Modulus of elasticity	205	GPa
Melting point	1450	°C
Proof strength Rp0.2	200-530	MPa
Tensile strength Rm	450-950	MPa
Elongation A	18-45	%
Impact strength KV	40-90 (transverse)	J
Weldability	covered by chemical composition	
Durability	covered by chemical composition	
Fracture toughness	covered by impact strength	
Cold formability	covered by elongation	

performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to /EN 10088-1:2014/, /EN 10028-7:2016/, /ASTM A240/, /ASME IID 2017/, /EN 10204:2005/, (not part of CE-marking).

2.4 Delivery status

Hot Rolled 1D and 1G surface finish condition according to /**EN 10088-1**/ and in accordance with /**EN 10204**/. The dimensions of the declared product may vary according to the final use.

The products are certified in accordance with product standards :
/EN 10088-1/
/EN 10028-7/
/ASTM A240/
/ASME IID/
/EN 10204/

2.5 Base materials / Ancillary materials

Manufacturing is based on recycling and ferrous scrap (predominantly stainless steel scrap) is used as a major raw material. Alloying elements are also added as ferroalloys or metals. The most common alloying elements are chromium, nickel, molybdenum, manganese and silicon. Other elements, for example nitrogen, niobium and titanium may also be present in the stainless steel. The presence and rates of these alloying elements depend on the stainless steel designation as set out in /**EN 10088-1**/. All stainless steels contain at least 10.5 % chromium.

Substances listed on the “Candidate List of Substances of Very High Concern for Authorisation” by the European Chemicals Agency are not contained in stainless steel in declarable quantities.

2.6 Manufacture

The steel scrap is melted in an electric arc furnace to obtain a steel melt. The liquid steel is further refined (adjustment of sulphur, carbon and phosphorous) and alloyed to give the stainless steel the required characteristics. The molten steel is then cast into semi-finished steel products like slabs or billets. The semi-finished steel products are hot rolled to the desired thickness and then annealed and pickled.

2.7 Environment and health during manufacturing

Environmental, occupational health and safety and quality management are in accordance with /**ISO 14001**/, /**ISO 9001**/ and /**OHSAS 18001**/

2.8 Product processing/Installation

Processing and installation of the steel coil, sheet or plate has to be carried out according to generally recognized engineering rules and the manufacturer’s recommendation depending on the respective application.
Eurocodes /**EC3**/ and /**EC4**/ apply to the design and construction. They include the requirements regarding performance, durability and fire resistance of steel structures. During handling and use of the products, normal occupational safety measures should be applied. Instructions from the manufacturer concerning welding as well as hot and cold forming are to be followed.
Under normal conditions no significant environmental impact to water, air or soil is known.
Residual material like steel scrap should be collected as it is 100% recyclable.

2.9 Packaging

Stainless sheets and plates are usually delivered with paper to protect the surface. This paper has been included in the EPD. In some cases, wooden pallets may be used for truck transport, although these have not been included in the EPD.

2.10 Condition of use

The maintenance requirements depend on the specific design and application, but typically stainless steel only requires a minimum of maintenance, for example, washing with mild detergents to maintain the product’s appearance.

2.11 Environment and health during use

Under normal conditions of use, no adverse health effects are known for stainless steel products.
Stainless steel does not release volatile organic compounds (VOCs) to indoor air.
Similarly no significant environmental impact to water, air or soil is expected, due to the extremely low metal release from stainless steel and the low maintenance need.

2.12 Reference service life

Service life is dependent upon physical and mechanical service conditions. Correct alloy designation choice can satisfy a required service life.

2.13 Extraordinary effects

Fire
Structural steel products meet the requirements of building material safety class A1 (i.e. non-flammable according to /**EN 13501-1**/).

Water
In the event of unforeseeable exposure to water caused by sudden flooding, no risks to the environment or human health are expected to occur.

Mechanical destruction
In the event of mechanical destruction, no risks to the environment or human health are expected to occur.

2.14 Re-use phase

Stainless steel panels and structures are not generally reused at end-of-life. Reuse is possible and could take place providing that the reused component was able to meet the technical specifications required. Stainless steel is usually recycled and can be recycled to the same quality of steel without loss of properties.

2.15 Disposal

Stainless steel scrap is a valuable resource with well-established recycling routes. Disposal is not recommended, but no adverse environmental impact is known.
The /**European Waste Catalogue/** code for iron and steel products is 17 04 05.

2.16 Further information

For further information on these products please refer to http://www.outokumpu.com.

3. LCA: Calculation rules

3.1 Declared Unit

The declaration applies to one ton of hot rolled stainless steel product. The declared unit is the production and recycling of one ton of hot rolled stainless steel product.

Declared unit

Name	Value	Unit
Density	7900	kg/m^3
Conversion factor to 1 kg	1	-
Declared unit	1000	kg

3.2 System boundary

This EPD is cradle-to-gate with options, and includes the following process steps:

- Upstream production of raw materials, fuels and energy and all relevant upstream transport processes.
- Production/manufacturing of the stainless steel product.
- Waste water and treatment of wastes generated on site including swarf, dusts, scrap, slag and waste water.
- End-of-life (recycling, remelting or disposal of steel scrap).

3.3 Estimates and assumptions

95 % of hot rolled structural steel products are assumed to be recycled at end-of-life. The average hot rolled product produced by Outokumpu has a stainless steel scrap content of 71.35 % hence the net stainless steel scrap output is 23.65 % (95 % -71.35 %). This stainless steel scrap is declared as a credit in module D. This means that for each 1000 kg of hot rolled stainless steel product produced, 236.5 kg stainless steel scrap is credited.
The carbon steel scrap used as input is not included in these numbers as carbon steel scrap is considered an open loop with own burden.

End-of-Life Scenario

At end-of-life, a 95 % recycling rate for the steel product is assumed. The remaining 5 % is assumed to remain uncollected or to go to disposal e.g. landfill.

3.4 Cut-off criteria

All reported data were incorporated and modelled i.e. all raw materials, water, thermal and electrical energy and production waste.
The principal material transport processes (such as alloys and scrap) are also considered. Thus, even minor material and energy flows of less than 1 % mass are included.
Data for the sites were cross-checked with one another to identify potential data gaps. No processes, materials or emissions that are known to make a significant contribution to the environmental impact of the products studied have been omitted.
It can be assumed, that all excluded flows contribute less than 5% to the impact assessment categories. Packaging materials and its transportation are neglected due to low contribution to the overall life cycle results.
Machines, facilities and infrastructure required during manufacture are not taken into account.

3.5 Background data

Background data for upstream materials, fuels and energy production are taken from the /**GaBi Database**/.

3.6 Data quality

Production has been modeled using 2017 average production data provided by Outokumpu's own sites and has been quality-checked by Outokumpu and thinkstep.

3.7 Period under review

Modelling is based on production data from 2017. Background data used are from the 2018 version of /**GaBi Database**/. Documentation related to all the processes used in the stainless steel production model can be found in the GaBi documentation /**GaBi Documentation**/.

3.8 Allocation

Slag generated as a by-product of electric arc furnace (EAF) steelmaking is used as an input to a variety of industries including as a constituent of cement, in road building or as fill material.
This study has adopted a conservative approach and has assumed that all the environmental burdens associated with the production of stainless steel products and EAF slag are allocated to the production of steel, with slag included under the material for recycling (MFR) category.

Production losses of steel during the production process are recycled in a closed loop reducing the requirement for external scrap.

Specific information on allocation within the background data is given in the GaBi datasets documentation (/**GaBi Documentation/)**.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

.

4. LCA: Scenarios and additional technical information

For this steel product folling average end of life scenarios were considered with the corresponding benefits and burdens:
Landfilling of 5%, a recycling rate of 95%.
The stainless steel scrap input into Modul A is 713,5 kg; this results in a value of scrap benefit of 236,5 kg.

End of life (C3)

Name	Value	Unit
Landfilling	5	%

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
End-of-life recycling rate	95	%
Stainless steel scrap input (into module A)	71.35	%
Net stainless steel scrap credit	23.65	%
Equiv. Mass of stainless steel scrap credited per ton product	236.5	kg

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 t Hot Rolled Stainless Steel product

Parameter	Unit	A1-A3	C3	D
Global warming potential	[kg CO_2-Eq.]	2.74E+3	2.48E+0	-1.19E+3
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	4.29E-9	7.00E-12	-9.17E-13
Acidification potential of land and water	[kg SO_2-Eq.]	1.45E+1	9.61E-3	-7.50E+0
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	9.78E-1	1.19E-3	-4.14E-1
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	8.89E-1	6.99E-4	-4.48E-1
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	1.86E-1	1.14E-6	-6.54E-2
Abiotic depletion potential for fossil resources	[MJ]	3.24E+4	2.87E+1	-1.43E+4

RESULTS OF THE LCA - RESOURCE USE: 1 t Hot Rolled Stainless Steel product

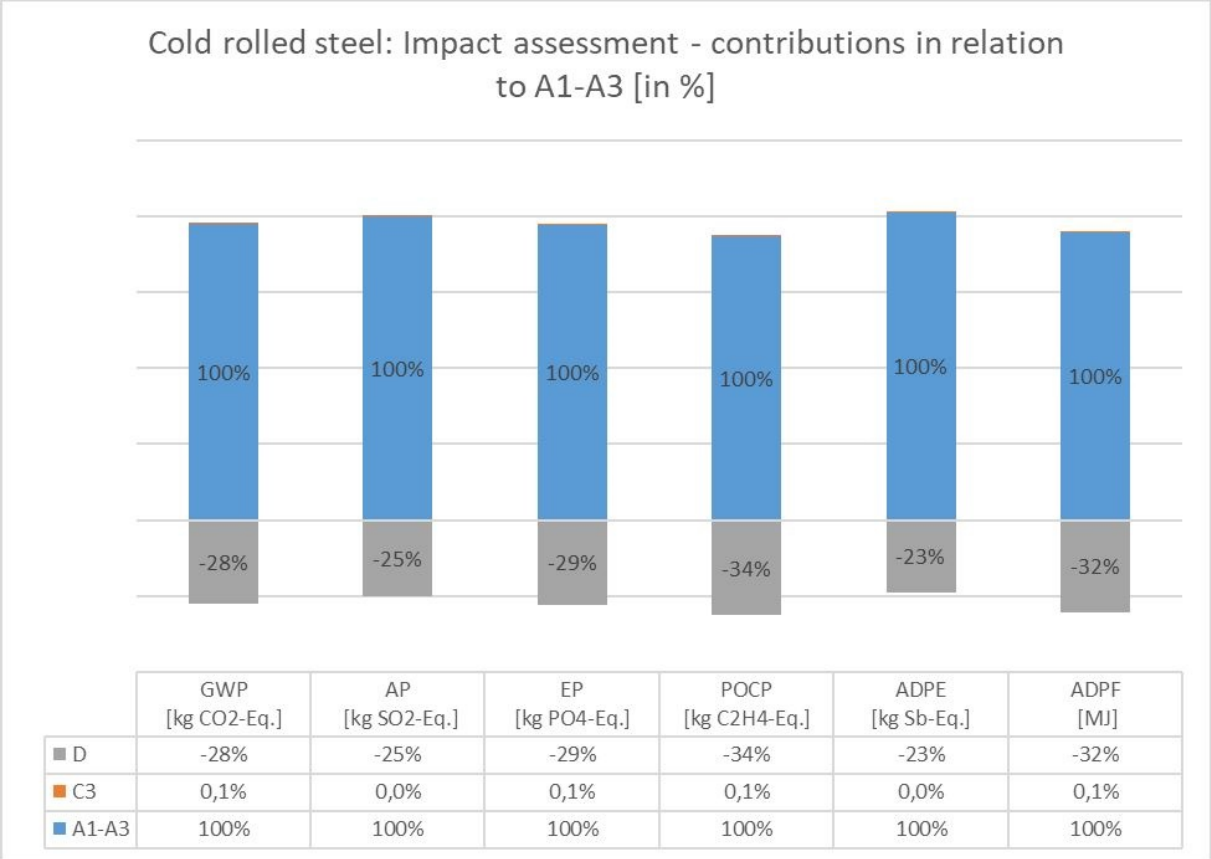
Parameter	Unit	A1-A3	C3	D
Renewable primary energy as energy carrier	[MJ]	7.67E+3	1.20E+1	-2.28E+3
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	7.67E+3	1.20E+1	-2.28E+3
Non-renewable primary energy as energy carrier	[MJ]	3.72E+4	4.07E+1	-1.45E+4
Non-renewable primary energy as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	3.72E+4	4.07E+1	-1.45E+4
Use of secondary material	[kg]	7.14E+2	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	3.40E+1	1.65E-2	-1.67E+1

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 t Hot Rolled Stainless Steel product

Parameter	Unit	A1-A3	C3	D
Hazardous waste disposed	[kg]	4.61E-2	3.28E-7	-1.50E-1
Non-hazardous waste disposed	[kg]	3.20E+2	5.01E+1	1.58E+1
Radioactive waste disposed	[kg]	1.95E+0	4.80E-3	-1.23E-1
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	9.50E+2	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0

6. LCA: Interpretation

This chapter contains an interpretation of the Life Cycle Impact Assessment categories with regards to the functional unit – 1 ton of stainless steel product. It focuses on the dominant contributions during the production process and recycling steel at its end of life.



	GWP [kg CO2-Eq.]	AP [kg SO2-Eq.]	EP [kg PO4-Eq.]	POCP [kg C2H4-Eq.]	ADPE [kg Sb-Eq.]	ADPF [MJ]
D	-28%	-25%	-29%	-34%	-23%	-32%
C3	0,1%	0,0%	0,1%	0,1%	0,0%	0,1%
A1-A3	100%	100%	100%	100%	100%	100%

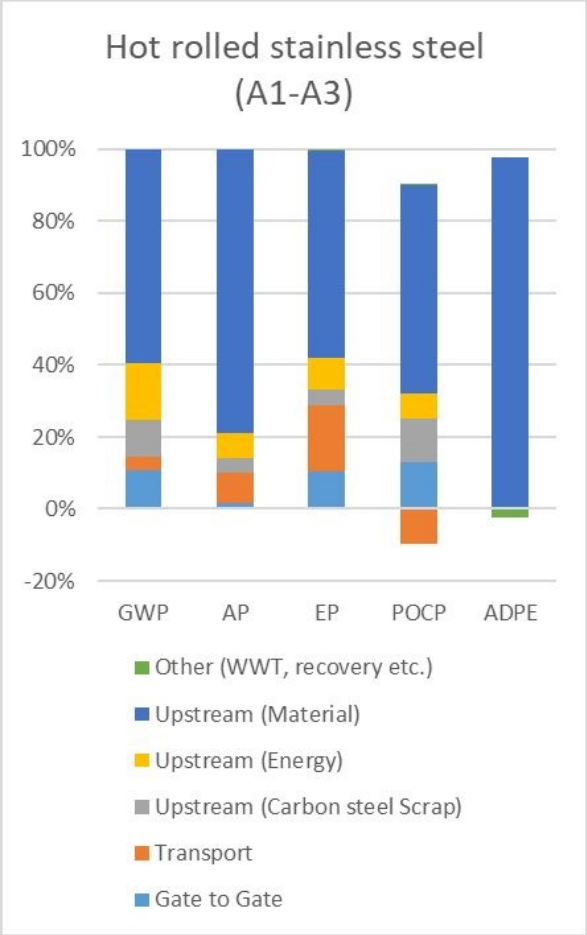
The figure above shows the relative contribution of the production stages (Module A1-A3), waste treatment (Module C3) and the benefits and loads beyond the product system boundary (Module D).
For all categories, the results for product stage (A1-3) contributes with the highest shares. Overall, C3 has a minimized contribution. The credits in Module D have a considerable share, thanks to the recycling.

The most relevant emissions on stainless steel production:
for **Global Warming Potential (GWP**) are CO2, CH4
for **Acidication Potential** (**AP)** are SO2 and NOx;
for **Eutrophication Potential (EP**) are NOx
for **Photochemical Ozone Creation Potential (POCP)** are CO, SO2, NOx, and NMVOC.

The main contribution to A1-A3 is the production of upstream materials, which is dominated by the production of the Fe-alloys Fe-Cr, Fe-Ni, Fe-Si, and Fe-Mo. The production of the listed Fe-alloys is high in energy consumption on Primary Energy Demand and registers high emissions of carbon dioxide, nitrogen oxides and sulphur dioxide with the resulting effect on Global Warming Potential, Acidification Potential, Eutrophication Potential and Photochemical Ozone Creation Potential.

In addition to the upstream material production, a certain influence on the overall results is given by the upstream energy production related to the electricity and fuel consumption on-site. Depending on the location of the site this influence might vary related to the country specific energy supply.

The figure below summarises percentage contributions to selected impact category for each of the products (cradle-to-gate), showing the large contribution from upstream materials.



7. Requisite evidence

This EPD covers hot rolled products which are likely to be employed in a variety of applications including structures such as heavy transport, bridges and floodgates, building fixings, traffic barriers, and façade components, many of which will require further processing and fabrication related to the final application. Consequently, further documentation is not applicable.

7.1 Weathering performance

Where hot rolled stainless steel is used in an external application, no corrosion shall occur as stainless steel is inherently non-corrosive. For this reason, stainless steel products are often applied where corrosion resistance is a key performance characteristic.

8. References

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ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

Owner of the Declaration	**Outokumpu Oyj**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-OTO-20190107-IBD1-EN
Issue date	19/09/2019
Valid to	18/09/2024

Stainless Steel Long Product

Outokumpu Oyj

Institut Bauen und Umwelt e.V.

www.ibu-epd.com / https://epd-online.com

1. General Information

Outokumpu	Stainless Steel Long Product
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the declaration** Outokumpu Oyj Salmisaarenranta 11 FI-00181 Helsinki Finland
Declaration number EPD-OTO-20190107-IBD1-EN	**Declared product / declared unit** This EPD applies to 1 ton of stainless steel long product. It covers steel delivered as sheet or as plate for various applications for building and civil work.
This declaration is based on the product category rules: Structural steels, 07.2014 (PCR checked and approved by the SVR)	**Scope:** The declaration applies to 1 ton of stainless steel long product produced by Outokumpu. The Life Cycle Assessment is based on data from the following Outokumpu production plants: - Outokumpu Stainless Ltd, Sheffield, UK - Outokumpu Stainless USA LLC, Richburg, SC, USA - Fagersta Stainless AB, Fagersta, Sweden Production has been modeled using annual production data from 2017 and 2018. Where required averaging is based on production output from each site. The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.
Issue date 19/09/2019	
Valid to 18/09/2024	**Verification** The standard /EN 15804/ serves as the core PCR Independent verification of the declaration and data according to /ISO 14025:2010/ ☐ internally ☒ externally
Dipl. Ing. Hans Peters (President of Institut Bauen und Umwelt e.V.)	
Dr. Alexander Röder (Managing Director IBU)	Angela Schindler (Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition

This EPD describes stainless steel long products produced by Outokumpu. Long products are supplied as black, peeled or cold drawn bar or as rod coil. The computerised process control of our rolling mills, heat treatment facilities, and finishing lines ensures consistency and superior control of the targeted properties. Stainless steel long products are available in a wide range of sizes in both standard and special grades. This EPD is applicable to homogeneous Outokumpu stainless steel long products which are used in the construction and building industry. The data have been provided by a representative mix of four manufacturing plants in the UK, USA and Sweden.

For the placing on the market of the product in the EU/EFTA (with the exception of Switzerland) Regulation (EU) No. 305/2011 (CPR) applies.
The product needs a declaration of performance taking into consideration /EN 10088-5:2009/: Stainless steels. Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels for construction purposes.
For the application and use the respective national provisions apply.

2.2 Application

Long products are used in a wide range of applications in building and construction. Typical applications are fixings, wall ties, couplings, and dowel bars.

2.3 Technical Data

Constructional data

Name	Value	Unit
Density	7900	kg/m^3
Modulus of elasticity	205000	N/mm^2
Coefficient of thermal expansion	14	$10^{-6}K^{-1}$
Thermal conductivity	19	W/(mK)
Melting point	1450	°C
Proof Strength Rp 0.2	175-1000	MPa
Tensile Strength Rm	450-950	MPa
Elongation A	10-45	%

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to /EN 10088-5:2009/: Stainless steel. Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels for construction purposes. /EN 10272/, /ASTM A276/, /ASME IID/, /JIS G4303/ (not part of CE marking).

2.4 Delivery status

The products are produced in accordance with various national and/or international technical regulations. The products are certified in accordance with product standards:
/EN 10088-5/
/EN 10272/
/ASTM A276/
/ASME IID/
/JIS G4303/

More detailed information on technical properties in the Outokumpu brochure “Steel Grades, Properties and Global Standards”. The dimensions of the declared product may vary according to the final use

2.5 Base materials / Ancillary materials

Stainless steels are iron alloys that contain more than 10.5% chromium and less than 1.2% carbon. Composition below is given in weight percentages

Chromium: 10.5% to 30%
Nickel: max. 38%
Molybdenum: max. 11%
Carbon: max. 1.2%
Iron: balance (>50%)

Manufacturing is based on recycling and ferrous scrap, (predominantly stainless steel scrap) is used as raw material. Alloying elements are also added as ferroalloys or metals. Other elements such as Manganese (Mn), Nitrogen (N), Niobium (Nb), Titanium (Ti), Copper (Cu) and Silicon (Si) may be present. The presence and rates of these alloying elements depend on the stainless steel designation as set out in /EN 10088-1/.
This product contains substances listed in the candidate list (date: 05.08.2019) exceeding 0.1 percentage by mass: no
This product contains other CMR substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass: no
Biocide products were added to this construction product or it has been treated with biocide products: no

2.6 Manufacture

The steel scrap is melted in an electric arc furnace to obtain a steel melt. The liquid steel is further refined (adjustment of sulfur, carbon and phosphorous) and alloyed to give the stainless steel the required characteristics. The steel is then cast into semi-finished stainless steel products, for example billets. The billets are hot rolled to the desired bar size or the billets are hot rolled to rod coil and then annealed and pickled. The bar can also be peeled and the rod coil cold drawn and cut to bar.
Quality management are in accordance with /ISO 9001/.

2.7 Environment and health during manufacturing

Environmental, occupational health and safety management are in accordance with /**ISO 14001**/ and /**OHSAS 18001**/.

2.8 Product processing/Installation

Processing of the rod coil or bar lengths has to be carried out depending on the respective application according to the generally recognised rules of engineering and the manufacturer’s recommendation. Eurocode 3 and 4 **/EC3/** and **/EC4/** apply to the design of construction. EC3 and EC4 include requirements regarding performance, durability and fire resistance of steel and composite structures.

During handling and the use of the products, normal occupational safety measures should be applied. Any instructions from the manufacturer concerning welding as well as hot and cold forming are to be followed.
Under normal conditions, there will be no significant environmental impact on water, air or soil.
Residual material, for example steel scrap, should be collected as it is 100% recyclable.

2.9 Packaging

Stainless steel long products are supplied in rod coil form or bar lengths using a combination of the following packaging systems:

- Plastic straps
- Galvanised strapping and plastic sleeves
- Lamiflex
- Plasticised paper
- Wooden boxes
- Polyweave
- Plastic straps and pallets.

2.10 Condition of use

The maintenance requirements depend on the specific design and application, but typically stainless steel only requires a minimum or no maintenance.

2.11 Environment and health during use

Under normal conditions of use, stainless steel products do not cause adverse health effects and stainless steel does not release volatile organic compounds (VOC) to indoor air.
Similarly, no significant environmental impact on water, air or soil is expected, due to the extremely low metal release from stainless steel and the low maintenance need.

2.12 Reference service life

Service life is dependent upon corrosion environment, physical and mechanical service conditions. Correct alloy designation choice can satisfy a required service life.

2.13 Extraordinary effects

Fire

Structural steel products meet the requirements of building material safety class A1 (i.e. non-flammable according to /**EN 13501-1**/)

Fire protection

Name	Value
Building material class	A1

Water

In the event of unforeseeable exposure to water caused by sudden flooding, no risks to the environment or human health are expected to occur.

Mechanical destruction

In the event of mechanical destruction, no risks to the environment or human health are expected to occur.

2.14 Re-use phase

Stainless steel structures are not generally reused at end-of-life. Reuse is possible and could take place providing that the reused component was able to meet the technical specifications required. Stainless steel is usually recycled and can be recycled to the same quality of steel without loss of properties.

2.15 Disposal

Stainless steel scrap is a valuable resource with well-established recycling routes. Disposal is not recommended, but no adverse environmental impact is known.

The /**European Waste Catalogue**/ code for iron and steel products is 17 04 05.

2.16 Further information

For further information on these products please refer to http://www.outokumpu.com.

3. LCA: Calculation rules

3.1 Declared Unit

The declaration applies to one ton of stainless steel long product. The declared unit is the production and recycling of one ton of stainless steel long product.

Declared unit

Name	Value	Unit
Declared unit	1000	kg

3.2 System boundary

This EPD is cradle-to-gate with options, and includes the following process steps:

- Upstream production of raw materials, fuels and energy and all relevant upstream transport and packaging processes.
- Production/manufacturing of the stainless steel product.
- Waste water and treatment of wastes generated on site including swarf, dusts, scrap, slag and waste water.
- End-of-life (recycling, remelting or disposal of steel scrap).

3.3 Estimates and assumptions

Primary data was used to model all on-site processes. This data was cross-checked to identify and eliminate data gaps. High quality secondary data from the GaBi database was used to model upstream material and energy flows. Secondary data was as technologically and geographically representative as possible. However, for some of minor auxiliary materials such as limestone, grease, lubricant similar or best estimated datasets are used to make sure that the data was still considered to be technologically representative for European production.

Due to lack of available dataset for some alloying elements e.g. Ferro-Vanadium South-African data sets were used instead of local data. It's considered as conservative choice.

Sorting and Shredding data from Ecoinvent Database is chosen to model the module C3.

At end-of-life, a 95 % recycling rate for the steel product is assumed. The remaining 5 % is assumed to remain uncollected or to go to disposal e.g. landfill.

3.4 Cut-off criteria

All reported data were incorporated and modelled i.e. all raw materials, water, thermal and electrical energy, and production waste.

The principal material transport processes (such as alloys and scrap) are also considered. Thus, even minor material and energy flows of less than 1 % mass are included.

Data for the sites were cross-checked with one another to identify potential data gaps. No processes, materials or emissions that are known to make a significant contribution to the environmental impact of the products studied, have been omitted.

It can be assumed, that all excluded flows contribute less than 5% to the impact assessment categories.

These packaging materials and its transportation were considered in data collection and in LCA model but doesn't have noticeable effects on the results.

Machines, facilities, and infrastructure required during manufacture are not taken into account.

3.5 Background data

Background data for upstream materials, fuels, and energy production are taken from the /**GaBi Database SP36**/.

3.6 Data quality
Production has been modeled using 2017 average production data provided by Outokumpu's own sites and has been quality-checked by Outokumpu and thinkstep.

3.7 Period under review
Modelling is based on production data from 2017. Background data used are from the 2018 version of /**GaBi Database SP36**/. Documentation related to all the processes used in the stainless steel production model can be found in the GaBi documentation /**GaBi Documentation**/.

3.8 Allocation
Slag generated as a by-product of electric arc furnace (EAF) steelmaking is used as an input to a variety of industries including as a constituent of cement, in road building or as fill material.
This study has adopted a conservative approach and has assumed that all the environmental burdens associated with the production of stainless steel products and EAF slag are allocated to the production of steel, with slag included under the material for recycling (MFR) category.

Production losses of steel during the production process are recycled in a closed loop reducing the requirement for external scrap.

Specific information on allocation within the background data is given in the GaBi datasets documentation (/**GaBi Documentation/)**.

3.9 Comparability
Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

.

4. LCA: Scenarios and additional technical information

For this steel product following the average end of life scenarios were considered with the corresponding benefits and burdens:
Landfilling of 5 %, a recycling rate of 95 %.
The stainless steel scrap input into Modul A is 760,4 kg; this results in a value of scrap benefit of 189,6 kg.

End of life (C3)

Name	Value	Unit
Sorting&Shredding	100	%

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
End-of-life recycling rate	95	%
Stainless steel scrap input (into module A)	76	%
Net stainless steel scrap credit	19	%
Equiv. Mass of stainless steel scrap credited per ton product	189,6	kg

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 t Stainless Steel Long Product

Parameter	Unit	A1-A3	C3	D
Global warming potential	[kg CO_2-Eq.]	2.89E+3	2.48E+0	-9.53E+2
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	4.16E-9	7.00E-12	-7.35E-13
Acidification potential of land and water	[kg SO_2-Eq.]	2.09E+1	9.61E-3	-6.01E+0
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	1.09E+0	1.19E-3	-3.32E-1
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	9.50E-1	6.99E-4	-3.59E-1
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	1.97E-1	1.14E-6	-5.24E-2
Abiotic depletion potential for fossil resources	[MJ]	3.16E+4	2.87E+1	-1.14E+4

RESULTS OF THE LCA - RESOURCE USE: 1 t Stainless Steel Long Product

Parameter	Unit	A1-A3	C3	D
Renewable primary energy as energy carrier	[MJ]	7.33E+3	1.20E+1	-1.83E+3
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	7.33E+3	1.20E+1	-1.83E+3
Non-renewable primary energy as energy carrier	[MJ]	3.72E+4	4.07E+1	-1.16E+4
Non-renewable primary energy as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	3.72E+4	4.07E+1	-1.16E+4
Use of secondary material	[kg]	7.60E+2	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	3.23E+1	1.65E-2	-1.34E+1

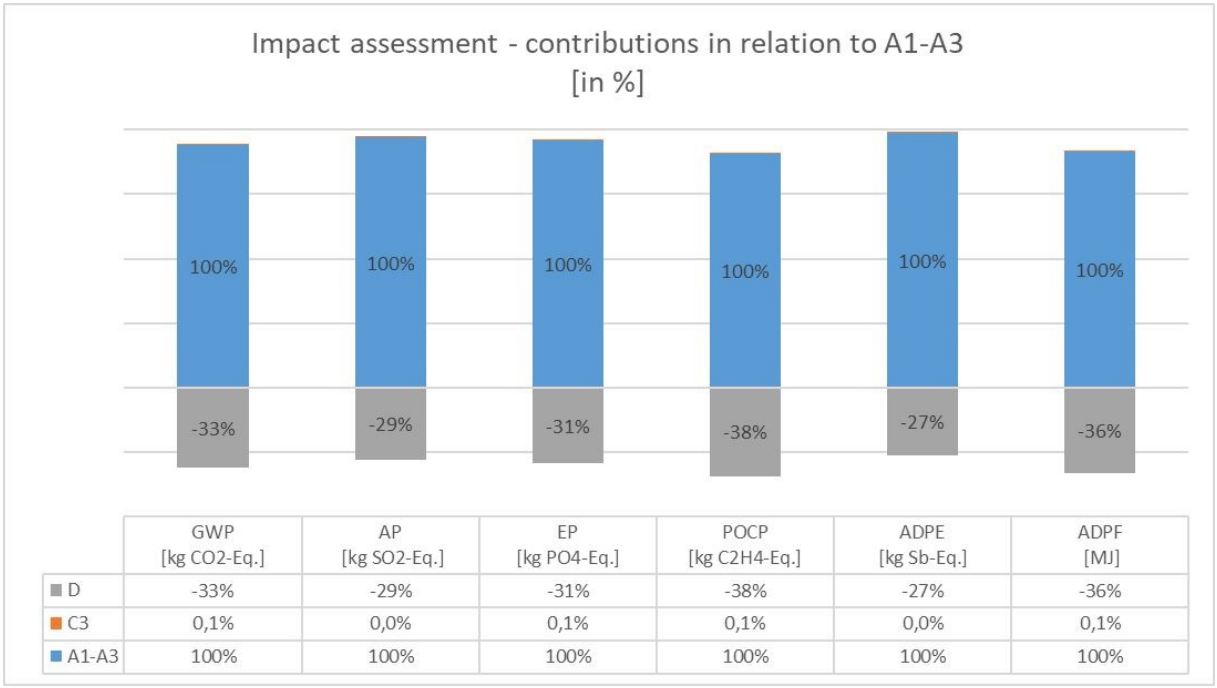
RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 t Stainless Steel Long Product

Parameter	Unit	A1-A3	C3	D
Hazardous waste disposed	[kg]	3.30E-2	3.28E-7	-1.20E-1
Non-hazardous waste disposed	[kg]	2.16E+2	5.01E+1	1.27E+1
Radioactive waste disposed	[kg]	2.30E+0	4.80E-3	-9.82E-2
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	9.50E+2	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0

*NOTE: The results above represent an average of multiple production routes & sites as well as multiple stainless steel grades for Long product – produced at Outokumpu. In case of specific product with precise information on manufacturing site and/or grade of steel, an individual request to Outokumpu is required.

6. LCA: Interpretation

This chapter contains an interpretation of the Life Cycle Impact Assessment categories with regards to the functional unit – 1 ton of stainless steel product. It focuses on the dominant contributions during the production process and recycling steel at its end of life.



	GWP [kg CO2-Eq.]	AP [kg SO2-Eq.]	EP [kg PO4-Eq.]	POCP [kg C2H4-Eq.]	ADPE [kg Sb-Eq.]	ADPF [MJ]
D	-33%	-29%	-31%	-38%	-27%	-36%
C3	0,1%	0,0%	0,1%	0,1%	0,0%	0,1%
A1-A3	100%	100%	100%	100%	100%	100%

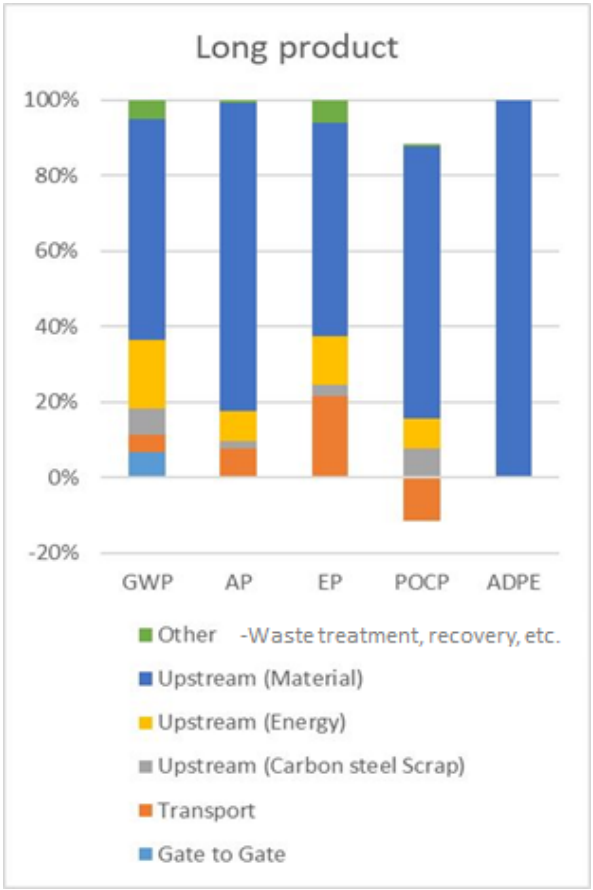
The figure above shows the relative contribution of the production stages (Module A1-A3), waste treatment (Module C3) and the benefits and loads beyond the product system boundary (Module D).
For all categories, the results for the product stage (A1-3) contributes with the highest shares. Overall, C3 has a minimized contribution. The credits in Module D have a considerable share, thanks to the recycling.

The most relevant emissions on stainless steel production:
for **Global Warming Potential (GWP**) are CO2, CH4
for **Acidification Potential** (**AP)** are SO2 and NOx;
for **Eutrophication Potential (EP**) are NOx
for **Photochemical Ozone Creation Potential (POCP)** are CO, SO2, NOx, and NMVOC.

The main contribution to A1-A3 is the production of upstream materials, which is dominated by the production of the Fe-alloys Fe-Cr, Fe-Ni, Fe-Si, and Fe-Mo. The production of the listed Fe-alloys is high in energy consumption on Primary Energy Demand and registers high emissions of carbon dioxide, nitrogen oxides, and sulfur dioxide with the resulting effect on Global Warming Potential, Acidification Potential, Eutrophication Potential and Photochemical Ozone Creation Potential.

In addition to the upstream material production, a certain influence on the overall results is given by the upstream energy production related to the electricity and fuel consumption on-site. Depending on the location of the site this influence might vary related to the
country-specific energy supply.

The following figure summarizes percentage contributions to selected impact category for each of the products (cradle-to-gate), showing the large contribution from upstream materials.



7. Requisite evidence

This EPD covers stainless steel long products which are likely to be employed in a variety of applications including building envelopes, interior cladding and paneling, heating, cooling and ventilation, lifts and elevators, many of which will require further processing and fabrication related to the final application. Consequently, further documentation is not applicable.

7.1 Weathering performance

The majority of the applications described in section 2.2 relate to the interior of buildings. However, where the stainless steel long product is used in an external application, no corrosion shall occur as stainless steel is inherently non-corrosive. For this reason, stainless steel products are often applied where corrosion resistance is a key performance characteristic such as marine environments.

8. References

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/ISO 14025/
DIN EN /ISO 14025:2011-10/, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

/EN 15804/
/EN 15804:2012-04+A1 2013/, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

/PCR Part A/
Product Category Rules for Building-Related Products and Services, Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report. Version 1.8, 07.2019. Institut Bauen und Umwelt e.V. (IBU) www.bau-umwelt.de

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Institut Bauen und Umwelt e.V., Berlin (pub.): PCR Guidance Texts for Building Related Products and Services, Part B: Requirements on the EPD for Structural Steels. 2017

/CPR/
Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products

/EN 10088-1/
EN 10088-1:2014: Stainless Steels. List of stainless steels

/EN 10088-5/
EN 10088-5:2009: Stainless steels. Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels for construction purposes.

/EN 10272/
EN 10272:2007: Stainless steel bars for pressure purposes

/ASTM A276/
ASTM A276: Standard specification for stainless steel plate bars and shapes

/ASME II-D/
ASME II-D: 2017: BPVC Section II Materials Part D - Properties

/JIS G4303/
JIS G4303:2012: Stainless steel bars

/SVHC/
Candidate List of substances of very high concern for Authorisation in accordance with Article 59(10) of the REACH Regulation (EC) No 1907/2006 as of 30 June 2019

/ISO 9001/
ISO 9001:2015: Quality management systems - Requirements

/ISO 14001/
ISO 14001:2015: Environmental management

/OHSAS 18001/
BS OHSAS 18001:2007: Occupational health and safety management systems – Requirements

/EC3/
EN 1993 – Eurocode 3: Design of steel structures

/EC4/
EN1994 – Eurocode 4: Design of composite steel and concrete structures

/EN 13501-1/
EN 13501-1: 2007: Fire classification of construction products and building elements-Part1

/European Waste Catalogue/
2000/532/EC - European Waste Catalogue. Commission Decision of 3 May 2000.

/GaBi Database SP36/
GaBi Software and Databasis for Life Cycle Engineering. IABP, University of Stuttgart und thinkstep AG, 2018.

/GaBi Documentation/
GaBi ts Documentation GaBi ts: Documentation of the GaBi datasets for Life Cycle Engineering. IABP,

University of Stuttgart und thinkstep AG, 2018. http://www.gabi-software.com/international/support/gabi/

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ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

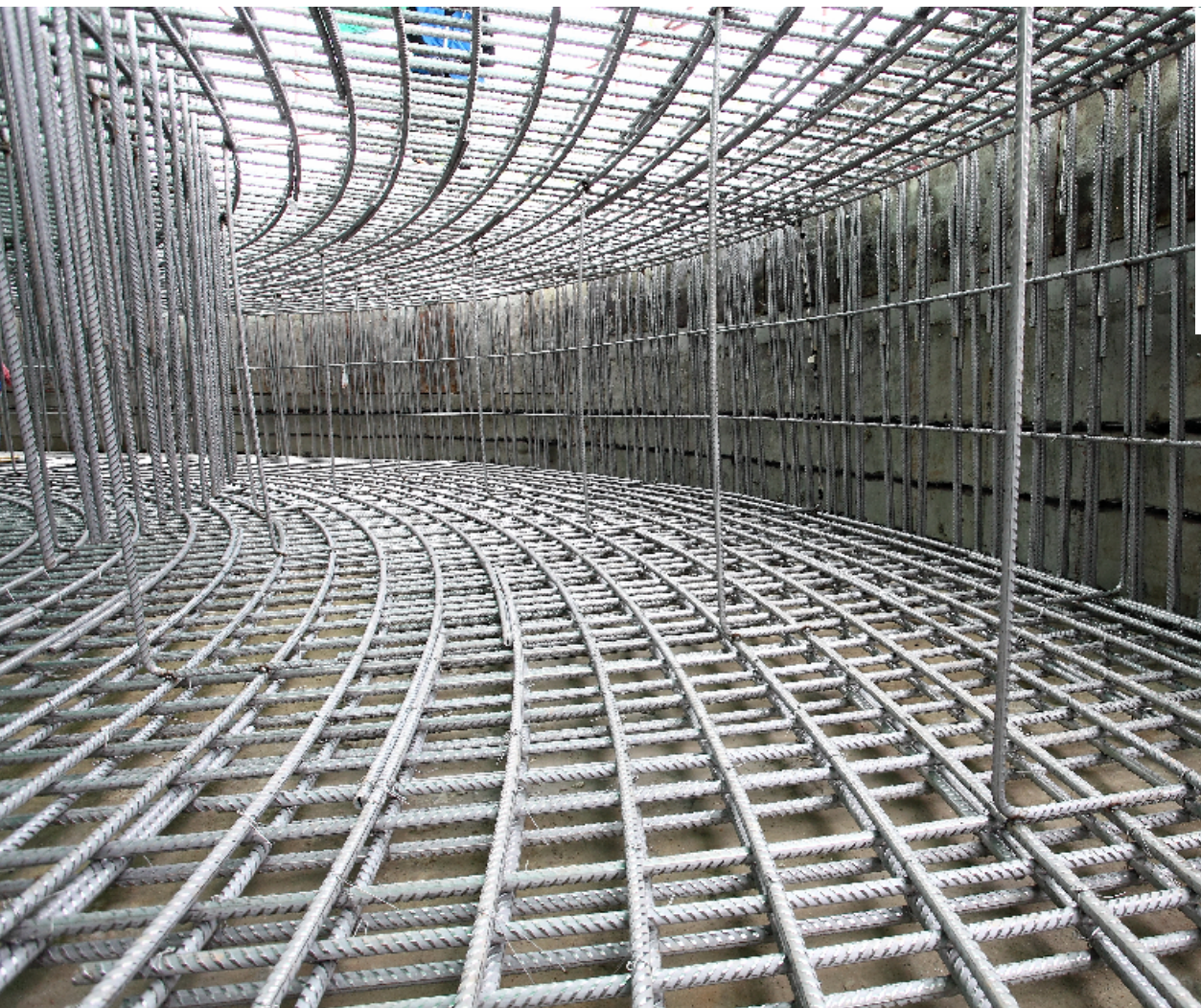
Owner of the Declaration	**Outokumpu Oyj**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-OTO-20190108-IBC1-EN
Issue date	19/09/2019
Valid to	18/09/2024

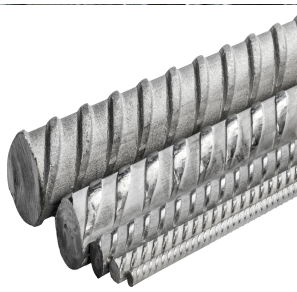
Stainless Steel Rebar

Outokumpu Oyj

Institut Bauen und Umwelt e.V.

www.ibu-epd.com / https://epd-online.com





1. General Information

Outokumpu	Stainless Steel Rebar
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the declaration** Outokumpu Oyj Salmisaarenranta 11 FI-00181 Helsinki Finland
Declaration number EPD-OTO-20190108-IBC1-EN	**Declared product / declared unit** This EPD applies to 1 ton of stainless steel rebar. It covers steel delivered for building and civil work.
This declaration is based on the product category rules: Structural steels, 07.2014 (PCR checked and approved by the SVR)	**Scope:** The declaration applies to 1 ton of stainless steel rebar produced by Outokumpu. The Life Cycle Assessment is based on data from the following Outokumpu production plants: - Outokumpu Stainless Ltd, Sheffield, UK Production has been modeled using annual production data from 2017. Where required averaging is based on production output from each site.
Issue date 19/09/2019	
Valid to 18/09/2024	
	The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.
	Verification The standard /EN 15804/ serves as the core PCR Independent verification of the declaration and data according to /ISO 14025:2010/ ☐ internally ☒ externally
Dipl. Ing. Hans Peters (President of Institut Bauen und Umwelt e.V.)	
Dr. Alexander Röder (Managing Director IBU)	Angela Schindler (Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition

This EPD describes stainless steel rebar produced by Outokumpu. Stainless steel rebar is supplied as coil, cut lengths, shapes or welded mesh. Stainless steel rebar is available in a wide range of sizes in both standard and special grades. The data have been provided by a representative mix of three manufacturing plants in the UK.

For the use and application of the product the respective national provisions at the place of use apply, in Germany for example the building codes of the countries and the corresponding national specifications.

2.2 Application

Stainless steel rebar is used as reinforcement in concrete. Stainless rebar replaces ordinary carbon steel rebar where non-magnetic reinforcement is required or as a durability solution for long-life design buildings or in aggressive environments (marine or other construction sites exposed to high chloride concentrations).

2.3 Technical Data

Constructional data

Name	Value	Unit
Density	7900	kg/m^3
Modulus of elasticity	205000	N/mm^2
Coefficient of thermal expansion	14	$10^{-6}K^{-1}$
Thermal conductivity	19	W/(mK)
Melting point	1450	°C

Performance data of the product with respect to its characteristics in accordance with the relevant technical provision (no CE-marking).

2.4 Delivery status

The products are produced in accordance with various national and/or international technical regulations. The

products are certified in accordance with product standards:

/EN 10088-1/
/BS 6744/
/BS 8666/
/ASTM A955/

The dimensions of the declared product may vary according to the final use.

2.5 Base materials / Ancillary materials

Stainless steels are iron alloys that contain more than 10.5% chromium and less than 1.2% carbon. Composition below is given in weight percentages:

Chromium: 10.5% to 30%
Nickel: max. 38%
Molybdenum: max. 11%
Carbon: max. 1.2%
Iron: balance (>50%)

Manufacturing is based on recycling and ferrous scrap, (predominantly stainless steel scrap) is used as raw material. Alloying elements are also added as ferroalloys or metals. Other elements such as Manganese (Mn), Nitrogen (N), Niobium (Nb), Titanium (Ti), Copper (Cu) and Silicon (Si) may be present. The presence and rates of these alloying elements depend on the stainless steel designation as set out in /EN 10088-1/.
This product contains substances listed in the candidate list (date: 05.08.2019) exceeding 0.1 percentage by mass: no
This product contains other CMR substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass: no
Biocide products were added to this construction product or it has been treated with biocide products: no

2.6 Manufacture

The steel scrap is melted in an electric arc furnace to obtain a steel melt. The liquid steel is further refined (adjustment of sulfur, carbon and phosphorous) and alloyed to give the stainless steel the required characteristics. The molten steel is then cast into billets before being sent to the rolling mill where they are rolled to the required dimensions. After hot rolling the steel is pickled and coiled to rod. The stainless steel rebar rod coil can be cut to straightened lengths or bent to shape.
Quality management are in accordance with /ISO 9001/.

2.7 Environment and health during manufacturing

Environmental, occupational health and safety management are in accordance with /**ISO 14001**/ and /**OHSAS 18001**/.

2.8 Product processing/Installation

Processing of the coil, lengths or shapes has to be carried out depending on the respective application according to the generally recognised rules of engineering and the manufacturer's recommendation.

Eurocode 2 **/EC2/** applies to the design of concrete structures. EC2 includes requirements regarding performance, durability and fire resistance of concrete structures.

During handling and the use of the products, normal occupational safety measures should be applied. Any instructions from the manufacturer concerning welding as well as hot and cold forming are to be followed.
Under normal conditions there will be no significant environmental impact on water, air or soil.
Residual material, for example steel scrap, should be collected as it is 100% recyclable.

2.9 Packaging

Stainless reinforced bar is supplied in coil form, straight lengths or in shapes using plastic strapping.

2.10 Condition of use

The maintenance requirements depend on the specific design and application, but typically stainless steel only requires minimal or no maintenance.

2.11 Environment and health during use

Under normal conditions of use, stainless steel products do not cause adverse health effects and stainless steel does not release volatile organic compounds (VOC) to indoor air.

Similarly, no significant environmental impact on water, air or soil is expected, due to the extremely low metal release from stainless steel and the low maintenance requirements.

2.12 Reference service life

Stainless rebar is used in concrete to offer corrosion resistance to either carbonation-induced corrosion or chloride-induced corrosion.

In the case of carbonation-induced corrosion, the environment is not aggressive, and the service life of the rebar reinforced structure is up to 1000 years. Buildings do not generally have 1000-year lifetimes, but in these cases, the lifetime is limited by the use of the building or degradation of other structures in the building, not the rebar. Grade selection within standards is not an issue.

In the case of chloride-induced corrosion service life is dependent on grade selection being at least a critical chloride threshold level (CCTL) higher than the predicted chloride concentration at rebar depth for a given design life. There are several service life models commercially available to predict this chloride concentration; Outokumpu will provide test information on the CCTL of our stainless rebar.

2.13 Extraordinary effects

Fire
Structural steel products meet the requirements of building material safety class A1 (i.e. non-flammable according to /**EN 13501-1**/).

Fire protection

Name	Value
Building material class	A1

Water
In the event of unforeseeable exposure to water caused by sudden flooding, no risks to the environment or human health are expected to occur.

Mechanical destruction
In the event of mechanical destruction, no risks to the environment or human health are expected to occur.

2.14 Re-use phase
Stainless steel structures are not generally reused at end-of-life. Reuse is possible and stainless steel reinforced bar can be re-used after recovery. In order to maximise the potential to re-use or recycle stainless steel the design of the application should facilitate the disassembly at the end of its useful life.

2.15 Disposal
Stainless steel is 100% recyclable and keeps the same high quality when recycled. Recycling routes are well-established, and recycling is therefore the preferred disposal route.

Disposal is not recommended, but no adverse environmental impact is known.

The /**European Waste Catalogue**/ code for iron and steel products is 17 04 05.

2.16 Further information
For further information on these products please refer to http://www.outokumpu.com.

3. LCA: Calculation rules

3.1 Declared Unit
The declaration applies to one ton of stainless steel rebar. The declared unit is the production and recycling of one ton of stainless steel rebar.

Declared unit

Name	Value	Unit
Declared unit	1000	kg

3.2 System boundary
This EPD is cradle-to-gate with options, and includes the following process steps:

- Upstream production of raw materials, fuels and energy and all relevant upstream transport and packaging processes.
- Production/manufacturing of the stainless steel product.
- Waste water and treatment of wastes generated on site including swarf, dusts, scrap, slag, and waste water.
- End-of-life (recycling, remelting or disposal of steel scrap).

3.3 Estimates and assumptions
Primary data was used to model all on-site processes. This data was cross-checked to identify and eliminate data gaps. High quality secondary data from the GaBi database was used to model upstream material and energy flows. Secondary data was as technologically and geographically representative as possible. However, for some of minor auxiliary materials such as limestone, grease, lubricant similar or best estimated datasets are used to make sure that the data was still considered to be technologically representative for European production.

Due to lack of available dataset for some alloying elements e.g. Ferro-Vanadium South-African data sets were used instead of local data. It's considered as conservative choice.

Sorting and Shredding data from Ecoinvent Database is chosen to model the module C3.

At end-of-life, a 95 % recycling rate for the steel product is assumed. The remaining 5 % is assumed to remain uncollected or to go to disposal e.g. landfill.

3.4 Cut-off criteria
All reported data were incorporated and modelled i.e. all raw materials, water, thermal and electrical energy, and production waste.
The principal material transport processes (such as alloys and scrap) are also considered. Thus, even minor material and energy flows of less than 1 % mass are included.
No processes, materials or emissions that are known to make a significant contribution to the environmental impact of the products studied have been omitted.
It can be assumed, that all excluded flows contribute less than 5% to the impact assessment categories.
Packaging materials and its transportation were considered in data collection and in LCA model but doesn't have noticeable effects on the results.
Machines, facilities and infrastructure required during manufacture are not taken into account.

3.5 Background data
Background data for upstream materials, fuels and energy production are taken from the /**GaBi DatabaseSP36**/.

3.6 Data quality
Production has been modeled using 2017 average production data provided by Outokumpu's own sites and has been quality-checked by Outokumpu and thinkstep.

3.7 Period under review
Modelling is based on production data from 2017. Background data used are from the 2018 version of /**GaBi Database SP36**/. Documentation related to all the processes used in the stainless steel production model can be found in the GaBi documentation /**GaBi Documentation**/.

3.8 Allocation
Slag generated as a by-product of electric arc furnace (EAF) steelmaking is used as an input to a variety of industries including as a constituent of cement, in road building or as fill material.

This study has adopted a conservative approach and has assumed that all the environmental burdens associated with the production of stainless steel products and EAF slag are allocated to the production of steel, with slag included under the material for recycling (MFR) category.

Production losses of steel during the production process are recycled in a closed loop reducing the requirement for external scrap.

Specific information on allocation within the background data is given in the GaBi datasets documentation (/**GaBi Documentation/)**.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

4. LCA: Scenarios and additional technical information

For this steel product following the average end of life scenarios were considered with the corresponding benefits and burdens:
Landfilling of 5%, a recycling rate of 95%.
The stainless steel scrap input into Modul A is 721,5 kg; this results in a value of scrap benefit of 228,5 kg.

End of life (C3)

Name	Value	Unit
Sorting&Shredding	100	%

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
End-of-life recycling rate	95	%
Stainless steel scrap input (into module A)	72	%
Net stainless steel scrap credit	23	%
Equiv. Mass of stainless steel scrap credited per ton product	228,5	kg

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 t Stainless Steel Rebar

Parameter	Unit	A1-A3	C3	D
Global warming potential	[kg CO_2-Eq.]	3.78E+3	2.48E+0	-1.15E+3
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	4.42E-9	7.00E-12	-8.86E-13
Acidification potential of land and water	[kg SO_2-Eq.]	2.59E+1	9.61E-3	-7.24E+0
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	1.29E+0	1.19E-3	-4.00E-1
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	1.16E+0	6.99E-4	-4.33E-1
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	2.39E-1	1.14E-6	-6.32E-2
Abiotic depletion potential for fossil resources	[MJ]	3.86E+4	2.87E+1	-1.38E+4

RESULTS OF THE LCA - RESOURCE USE: 1 t Stainless Steel Rebar

Parameter	Unit	A1-A3	C3	D
Renewable primary energy as energy carrier	[MJ]	8.23E+3	1.20E+1	-2.20E+3
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	8.23E+3	1.20E+1	-2.20E+3
Non-renewable primary energy as energy carrier	[MJ]	4.45E+4	4.07E+1	-1.40E+4
Non-renewable primary energy as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	4.45E+4	4.07E+1	-1.40E+4
Use of secondary material	[kg]	7.22E+2	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	3.90E+1	1.65E-2	-1.61E+1

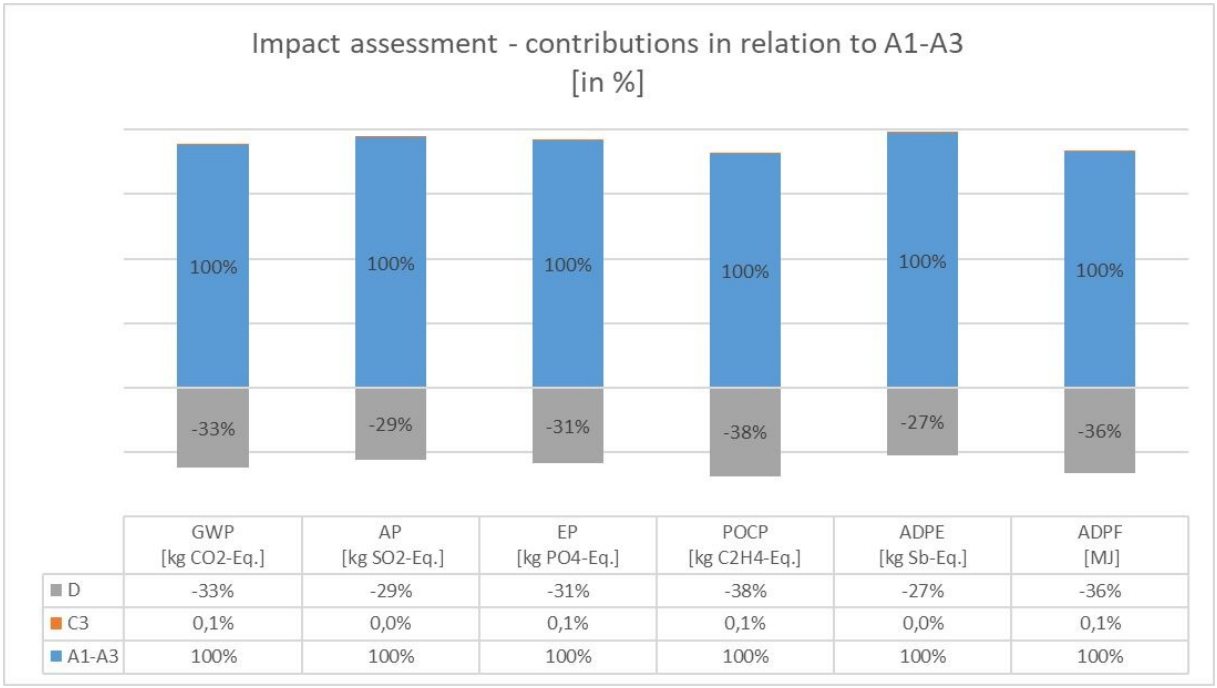
RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 t Stainless Steel Rebar

Parameter	Unit	A1-A3	C3	D
Hazardous waste disposed	[kg]	4.01E-2	3.28E-7	-1.45E-1
Non-hazardous waste disposed	[kg]	2.66E+2	5.01E+1	1.53E+1
Radioactive waste disposed	[kg]	2.44E+0	4.80E-3	-1.18E-1
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	9.50E+2	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0

*NOTE: The results above represent an average of multiple stainless steel grades for Rebar – produced at Outokumpu. In case of specific product with precise information on manufacturing site and/or grade of steel, an individual request to Outokumpu is required.

6. LCA: Interpretation

This chapter contains an interpretation of the Life Cycle Impact Assessment categories with regards to the functional unit – 1 ton of stainless steel rebar. It focuses on the dominant contributions during the production process and recycling steel at its end of life.



	GWP [kg CO2-Eq.]	AP [kg SO2-Eq.]	EP [kg PO4-Eq.]	POCP [kg C2H4-Eq.]	ADPE [kg Sb-Eq.]	ADPF [MJ]
D	-33%	-29%	-31%	-38%	-27%	-36%
C3	0,1%	0,0%	0,1%	0,1%	0,0%	0,1%
A1-A3	100%	100%	100%	100%	100%	100%

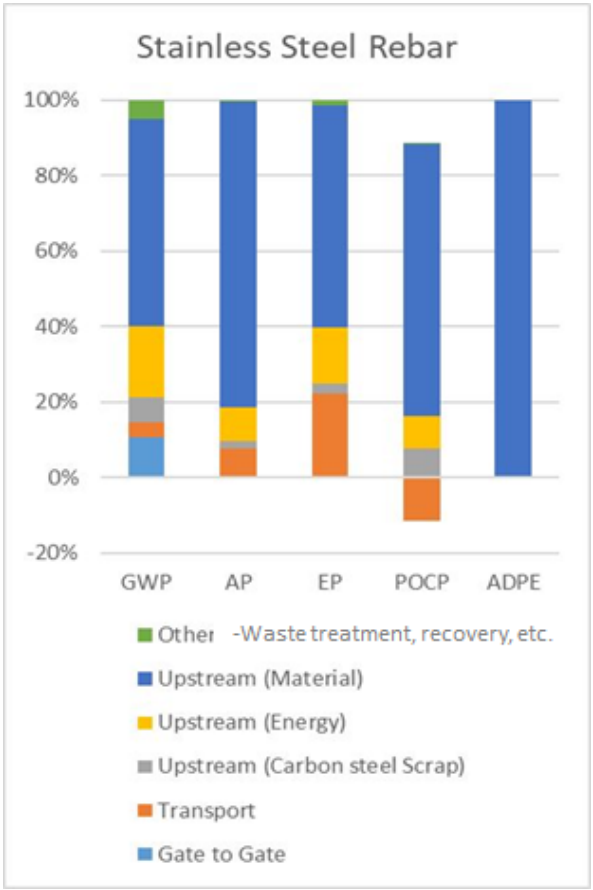
The figure above shows the relative contribution of the production stages (Module A1-A3), waste treatment (Module C3) and the benefits and loads beyond the product system boundary (Module D).
For all categories, the results for the product stage (A1-3) contributes with the highest shares. Overall, C3 has a minimized contribution. The credits in Module D have a considerable share, thanks to the recycling.

The most relevant emissions on stainless steel production:
for **Global Warming Potential (GWP**) are CO2, CH4
for **Acidification Potential** (**AP)** are SO2 and NOx;
for **Eutrophication Potential (EP**) are NOx
for **Photochemical Ozone Creation Potential (POCP)** are CO, SO2, NOx, and NMVOC.

The main contribution to A1-A3 is the production of upstream materials, which is dominated by the production of the Fe-alloys Fe-Cr, Fe-Ni, Fe-Si, and Fe-Mo. The production of the listed Fe-alloys is high in energy consumption on Primary Energy Demand and registers high emissions of carbon dioxide, nitrogen oxides, and sulfur dioxide with the resulting effect on Global Warming Potential, Acidification Potential, Eutrophication Potential and Photochemical Ozone Creation Potential.

In addition to the upstream material production, a certain influence on the overall results is given by the upstream energy production related to the electricity and fuel consumption on-site. Depending on the location of the site this influence might vary related to the country specific energy supply.

The following figure summarises percentage contributions to selected impact category for each of the products (cradle-to-gate), showing the large contribution from upstream materials.



7. Requisite evidence

7.1 Weathering performance

Stainless rebar is used in concrete to offer corrosion resistance to either carbonation-induced corrosion or chloride-induced corrosion.

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