GRÄNGES

Carbon footprint assessment of Gränges' aluminium products

Climate impact of flat rolled aluminium products
made by Gränges Americas Inc. in Huntingdon, TN, USA

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SUMMARY

In line with Gränges’ group-wide sustainability framework and accompanying targets to 2025, the company works to develop sustainable product offerings and provide clear and verified sustainability information on its products. This aim is to enable for customers and other stakeholders to understand, evaluate and compare Gränges’ products from a sustainability perspective.

Gränges' operations in Huntingdon, TN, USA have developed an internal life-cycle assessment (LCA) tool, which enables calculations and declarations of environmental impacts on a product level, starting with the carbon footprint. This carbon footprint assessment report outlines the methodological choices and allocations done to calculate the carbon footprint of products produced in the Huntingdon production site, according to the ISO 14040:2006 and ISO 14044:2006 standards as well as ISO 14067:2018. The report is intended for internal as well as external use including customers. Gränges’ process for carbon footprint calculations is reviewed and validated by an independent third-party reviewer and the review includes this report, the LCA tool and other documentation.

The calculations are made cradle to factory gate and thus include all process steps from bauxite mining to inbound transports, as well as all Gränges’ activities up until delivery from the site. The main materials that are used to produce the products are included, i.e. primary aluminium ingots, purchased external aluminium scrap and alloying elements. The functional unit is 1 tonne of finished product.

The calculations are made for individual product specs (articles) and also grouped by customer, alloy, and other sortable material characteristics. The report presents example results for three selected products. In general, the majority of the climate impact of Gränges’ products comes from the production of primary aluminium, i.e. primary aluminium ingots, which is an energy intensive process. The impact from Gränges’ own operations generally accounts for around 10 per cent of the total carbon footprint, and mainly relates to the casting and annealing processes, which are powered by natural gas, and the rolling process, which is powered by electricity. Impacts from alloying elements generally account for around 1 per cent and inbound transports for less than 1 per cent. Externally sourced aluminium scrap accounts for a very small portion of the climate impact as this material is modelled with a cut-off assumption and only includes climate impacts from processing and transport of the material. Internal aluminium scrap is treated as an internal flow and is recirculated within the product system.

The main implication from the carbon footprint assessment on Gränges’ products is that there are four clear ways in which Gränges can reduce the carbon footprint of its products: 1) Source more external recycled materials, 2) Source more low-carbon primary aluminium, 3) Reduce energy intensity in own operations, 4) Increase the use of renewable energy in own operations. Gränges’ climate strategy is to take product stewardship and reduce climate impact along the value chain, across the life-cycles of its products.

PREFACE

With the global push for sustainable development and the transformation into a more circular and resource-efficient economy, Gränges' customers are increasingly recognizing the importance of using sustainable materials. Aluminium is often called the "green metal" or "the metal of the future" thanks to its properties such as lightness, durability and infinite recyclability. Gränges works to leverage these unique properties to design and manufacture sustainable products, which can improve resource efficiency and climate performance along the value chain.

Having clear sustainability information on product level enables for Gränges' customers and other stakeholders to understand, evaluate and compare Gränges' products from a sustainability perspective. It also helps Gränges to build a solid fact base for innovation and performance improvements, with the aim to further design and develop customer offerings geared towards sustainability and circularity.

In this carbon footprint assessment report, Gränges presents the methodology, process and assumptions used to calculate the environmental impact of its flat rolled aluminium products, with a focus on the carbon footprint impact. The process and results have been third-party verified and additional information about the verification process can be found on Gränges' website.

AUTHORS

This Carbon Footprint report has been compiled by Mark Lienhart, SVP Procurement and Commercial HVAC Sales, with support from Sofia Hedevåg, SVP Sustainability. Mark Lienhart has acted as the Technical and methodology expert and Sofia Hedevåg as the Group sustainability lead for the LCA/CF project for all of Gränges.

ABBREVIATIONS

CO_2e = Carbon dioxide equivalents
t or tonne = metric tonne i.e. 1000 kg
HVAC = Heating, Ventilation, and Air Conditioning
TN = Tennessee
Spec = specification

1 INTRODUCTION

Aluminium is generally regarded as a sustainable material based on its recyclability, lightness, corrosion resistance, barrier properties etc. However, production of primary aluminium is energy intensive due to aluminium's strong affinity to oxygen and the process required to split aluminium from said oxygen. Recycling and remelting of aluminium save up to 95 per cent of the energy required to produce primary aluminium, but to maximize value of the aluminium to be remelted, a good sorting of different aluminium alloys is required.

Gränges' production site in Huntingdon, Tennessee, USA manufactures flat rolled aluminium products primarily for HVAC and Food Container applications but also for other segments. The process is further described in section 3. The largest product category is material for HVAC finstock condensers and evaporators for the heating and air conditioning systems in residential and commercial applications.

The plant is not connected to a primary smelter. In its casting operation, it melts sourced primary material and sourced internally recycled raw materials to make continuous cast coils. In its cold-rolling operations, it uses own produced cast coils or sourced coils (re-roll coils). Thus, a mix of primary and secondary aluminium is used. The sold product consists of one single aluminium alloy in a certain dimension and with properties specified by the customer (such as strength, formability, corrosion resistance etc.). The product is generally delivered as a coil, see Figure 1.

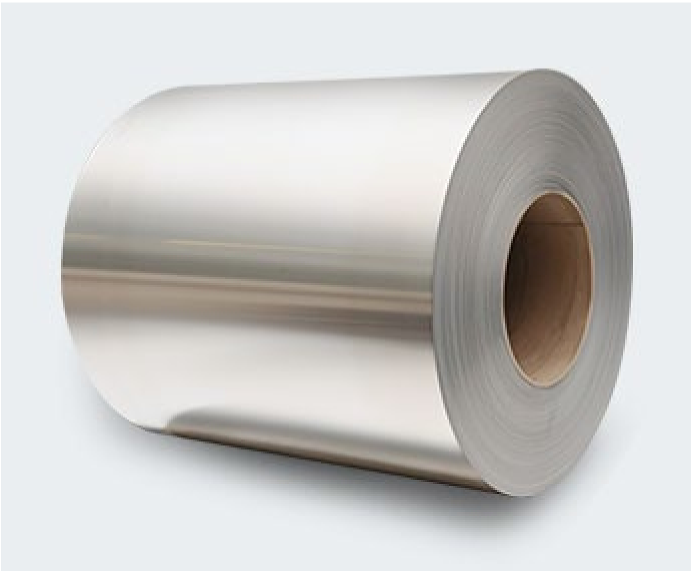

Figure 1. A typical coil delivered from Gränges Americas to customers.

This carbon footprint assessment report describes the methodological choices and allocations done to calculate carbon footprint of products according to the ISO 14040:2006 and ISO 14044:2006 standards as well as ISO 14067:2018. It is intended for internal as well as external use including customers.

Gränges' process for carbon footprint calculations is reviewed and validated by an independent third-party reviewer, including this report, the LCA tool used in the calculation as well as other documentation describing the process. The third-party verification covers a review of Gränges' processes and routines for conducting LCA, to secure that the methodology, data collection, calculations, result preparations and internal verifications delivers correct product carbon footprint results.

2 GOAL AND SCOPE

2.1 Goal

The goal is to have transparent, representative, and third-party verified carbon footprint data available for all products. The data shall be structured in a way so that it is easily updated at a pre-determined frequency. The data shall also serve as a fact base for performance improvements with regards to carbon footprint for individual products and the site in total. Communication of results shall be easy for stakeholders to understand, both in terms of calculation methods and the actual carbon footprint of the product. This is valid both internally and externally, so that for example customers can compare results for products from Gränges and similar assessment results from its competitors. The information will be summarized in a carbon footprint certificate. Another goal is to use the environmental performance data to develop product offerings geared towards sustainability and circularity.

2.2 Scope

2.2.1 System boundaries

The calculations are made cradle to factory gate. This means that all process steps from bauxite mining to inbound transports, together with all Gränges' activities up until delivery from the site, are included. Distribution, further processing and use of the products as well as end-of life treatment are excluded initially.

The products covered in this report are produced at Gränges Americas Inc. located in Huntingdon, TN in the United States.

The main materials that are used to produce the products are included, in terms of primary aluminium ingots, purchased external aluminium scrap, alloying elements, and some purchased re-roll coils. Packaging materials, rolling oil, and emulsions are included but other ancillary materials used in the production (such as process gases, chemicals, materials used in maintenance of equipment etc) have been excluded as they constitute significantly less than 1 per cent of the carbon footprint. Manufacturing of production equipment, buildings, and other capital goods, as well as travel to and from work for personnel are also excluded.

2.2.2 Functional unit

The functional unit is 1 metric tonne (1000 kg) of finished product, which is converted from pounds (which is the unit in which the customer purchases the product). A product is a rolled material with specified characteristics such as alloy composition, dimensions, mechanical properties etc. It is defined with a specific article number (spec).

2.2.3 Environmental impact categories

In this report, we only consider products' carbon footprint, expressed as Global Warming Potential (GWP) using IPCC GWP values for the 100-year time horizon.

Only GHG values for net fossil emissions are reported. Biogenic emissions and removals and GHG emissions and removals resulting from direct land use change (dLUC) is not reported separately. This is due to lack of data, the supplier specific data which is used for primary aluminium and energy only includes fossil emissions. Biogenic and dLUC emissions and removals are, however, assumed to be negligible.

Other impact categories may be added at a later stage. In a pilot study, several other categories were included and showed a very similar trend to carbon footprint. Thus, carbon footprint can at this point be used as a proxy for other environmental impact categories.

2.2.4 Key assumptions

The largest share of the carbon footprint for Gränges' products comes from the production of primary aluminium, in terms of primary aluminium ingots and purchased re-roll. When casting coils internally, each alloy is made on a specific recipe consisting of, for example, primary aluminium ingots, externally recycled aluminium, recycled aluminium from internal processes, alloying elements etc. The ingredients are melted, mixed, and cast into large cast coils. Externally sourced coils (re-roll) are made of primary aluminium and external scraps and mixed with the required alloying elements to meet the specified composition. Supplier specific data is used for production of reroll coils.

External aluminium scrap is modelled with a cut-off assumption, i.e. that the environmental impact of the original primary material production generating the recycled aluminium is not carried over to the recycled aluminium. This is in line with general practice for environmental product declarations in accordance with ISO 14025. Post-consumer and pre-consumer external aluminium scrap are treated in the same way. This is in line with the ISO 14021 definition of recycled content.

Alloying elements are added to the remelting process to achieve the correct composition of an alloy. In general, the share of alloying elements is relatively small, and therefore it is assumed that publicly available sources of alloying elements' environmental impact are good enough.

Internally cast material, "cast coils' are produced by the melting and mixing together of all raw materials listed above. These cast coils are produced in very large batches by alloy. These large batch cast campaigns regularly last 1-4 weeks long before a changeover occurs. The environment impact of the raw materials used in this production (scope 3) is therefore calculated at the alloy level for each product, based on the average input per cent of each raw material type over the given time period. Each alloy will have the same environmental impact factor for all products made out of that cast coil alloy.

When calculating the environmental impact of all internal process steps (casting, annealing, rolling, slitting, and packing) – an allocation method is used by which all of the energy used is applied at a spec level based on the individual machine utilization and the total energy allocated to each machine over the time period. 100 per cent of all energy used in the plant is allocated out on this basis across the total volume produced.

100 per cent of the process scrap generated in the internal production route is recycled back into products through the remelting process.

3 PROCESS AND DATA DESCRIPTION

Table 2 shows the input materials and processes included in the complete product system. Each input material and process is described below including data collection.

Table 2. Upstream and core processes.

Type of process	Process	Reference, chapter
Upstream processes	Primary aluminium	3.1
	External recycled aluminium	3.2
	Alloying elements	3.3
	Purchased reroll	3.4
	Energy	3.5
Core processes	Remelting and casting	3.7.1
	Rolling to packing	3.7.2
	Internal Recycled aluminium	3.7.3

3.1 Production of purchased primary aluminium

Aluminium is an abundant metal in the earth crust. It is easily oxidized and is therefore not found in its elemental state. It is bound to oxygen as Al_2O_3 and is generally mined from the mineral bauxite. Bauxite is found mostly in tropical climate areas. Mining of the bauxite is followed by a refining process, which results in commercially pure Al_2O_3. This oxide is then converted to aluminium through an electrolysis process in a so-called aluminium smelter. The result is primary aluminium with only low amounts of Fe and Si. The electrolysis process is an energy intensive process, in which also emissions of perfluorocarbons (PFC) are generated (included in data from suppliers). The primary aluminium is cast into ingots, billets, or slabs, either as commercially pure aluminium or alloyed with desired elements. The environmental impact of primary aluminium ingots covers the process from mining to casting of the ingot. The pre-mining activities concerning exploration and establishment of the mine are not included.

Gränges sources primary aluminium ingots from commodity traders and not directly from the primary aluminium producers. North American industry average data for primary aluminium production is used in calculating the environmental impact of primary aluminium.

3.2 Processing and transport of external recycled aluminium

Gränges sources aluminium scrap from external recycling companies. Most of the material comes from post-industrial usage, i.e. materials originating in various processing industries and direct customers of Gränges. Collection and transport of the recycled aluminium to the recycling companies as well as sorting of recycled materials at the recycling companies' sites are included. Gränges also ships some external scrap to 3rd party processors who remelt the scrap into an aluminium ingot, which is then transported to Gränges plants to be used in the casting process. These ingots are referred to as 'RSI' or Remelt Scrap Ingots.

The environmental impact of external aluminium scrap delivered to Gränges is estimated based on North American industry averages. The information is reviewed annually, based on the supplier mix, and updated when needed.

3.3 Production of alloying elements

Gränges sources alloying elements from several suppliers in different forms. Some are sourced in pure form, and some are sourced as a master alloy (mixed with aluminium to a certain share). As stated in section 2.2.4, the environmental impact of the alloying elements is low as the share of alloying elements added is generally low. Therefore, the production routes of these elements are not described.

Table 3 shows the major alloying elements used (in terms of sourced volume) and the form in which it is used (pure or master alloy). The production of alloying elements has been modelled using industry averages. The alloying elements represent less than 1 per cent of the total raw material used and have a marginal impact on the overall carbon footprint of each product produced.

Table 3. Major alloying elements used in cast coil production.

Alloying element	Form
Manganese (Mn)	Al40Mn60
Silicon (Si)	Al50Si50
Copper (Cu)	Copper metal
Iron (Fe)	Iron powder
Zinc (Zn)	Zinc Ingot
Titanium (Ti)	Aluminium wire with Ti and B

3.4 Production of reroll coils

Gränges sources purchased reroll coils from external rolling mills. These coils are basically produced in the same way Gränges produces its own internal cast coils. The coils are delivered according to Gränges' alloy specifications, and specific suppliers are approved to supply specific alloys.

The reroll coil suppliers to Gränges are required to provide their raw material mix information and an emissions factor is calculated similar to the way Gränges calculates the emissions of its own cast coil, which is used in Gränges' carbon footprint assessment calculations. Updates are made annually.

3.5 Energy sources

Gränges sources electricity and natural gas, which is used in its melting and casting as well as rolling to packing processes.

Electricity is sourced from one US electric supplier and the supplier specific cradle to gate carbon footprint for the delivered electricity is used. Various sources of fuel are used to generate the overall electricity generated by the supplier and those sources are used in the calculation of the environmental impact of electricity. Natural Gas is also sourced from one US natural gas supplier and the environmental impact is calculated based on the known emissions factor of natural gas

3.6 Gränges' production process on site

Figure 3 schematically illustrates the on-site process routes of Gränges' materials. All products follow the same general path from casting to packing. Some products have more cold rolling passes than others (depending on final thickness) and some have more annealing more than others (depending on temper or material properties required). The environmental impact of all these process steps is calculated based on the allocation method as defined above in the assumptions section.

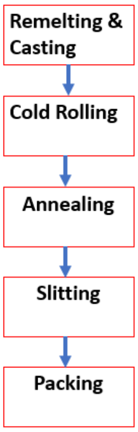

Figure 3. Schematic process route of Gränges' material.

3.6.1 Remelting and casting

Gränges would like to cast all of its cast coils in house but need to source a certain volume of reroll coils due to internal capacity constraints in casting. Generally, the in-house produced coils contain a much higher share of recycled aluminium while sourced coils contain mainly primary aluminium. Primary aluminium is required when the specification dictates low content of alloying elements such as iron and silicon.

In-house remelting and casting are done in large furnaces that are fuelled with natural gas. Raw materials are fed into a melting furnace where the right composition is ensured by melting, stirring, sample measurements, and addition of raw materials if needed to correct the composition. The melt is then transferred to a holding furnace, where cleaning of the melt from unwanted particles and inclusions is done. After that, the melt is led through a trough system into the continuous casting equipment where the metal solidifies into a sheet and is coiled into a very large cast coil. These coils can weigh up to 25 metric tonnes.

The raw materials used in production of the slabs are decided by a base recipe for each alloy. This recipe is however somewhat flexible depending on availability of raw materials, specifically the availability of aluminium scrap, which is prioritized over primary aluminium whenever possible.

The recipe used in the carbon footprint calculations is an average of all coils produced for each alloy over one year and is updated annually. The share of each input material is used to calculate the carbon footprint for each alloy.

The energy used is based on the total natural gas and electricity used based on the machine allocation method for all energy.

3.6.2 Rolling to packing

The exact process route is basically different for each product. The energy allocation method is used to determine the environmental impact of each production step by calculating the exact amount of energy used to produce each product over the course of the time period. 100 per cent of all energy deliver to the plant is allocated out to the products in this method and the exact environmental impact is calculated at a product level based on its exact production path from rolling to packing.

3.6.3 Internal aluminium scrap

Process scrap is generated along the process steps from casting to final product. This is unavoidable in this type of production and the total amount of such materials generated is used to calculate a recovery rate for each article produced. Depending on where in the process the materials fall, it will come in different forms making it more or less easy to recycle. 100 per cent of internally generated scrap is recycled and remelted.

The process scrap that is internally recycled carries a carbon footprint equal to the average of all purchased material of the alloy it came from. The impact of the process scrap is allocated between products as follows:

- process scrap that is recycled internally is allocated to the products that use the scrap as a raw material, based on the assumption that the material ending up as process scrap consists of an average mix of purchased materials. In the calculation, a carbon footprint is assigned to the internal scrap corresponding to the cradle-to-gate impact of the average mix of purchased materials for the alloy it is being recycled into.

The carbon footprint carried by internal aluminium scrap is updated annually based on amount of sourced metal and respective carbon footprint.

4 CALCULATIONS AND SELECTED RESULTS

The data described in section 3 have been inserted into an Excel calculation tool where necessary data is collected and compiled from internal and external sources. The data are organized in a way that makes calculation of carbon footprint easy for individual articles and groups of articles, see Chapter 8, Appendix 1 for details. Since the number of articles is very high (more than one thousand) it is beyond the scope of this report to show all the individual results.

Three selected examples are shown for illustration purposes. These three products represent three of the base alloys that make up over 80 per cent of the overall sales volume. The selection is done based on the fact that the raw material input has the strongest influence on environmental impact and the three examples are different in this respect. Each of the three examples are articles delivered in a relatively high volume to secure reliable data.

The results are shown in Figures 5, which clearly shows the dominating influence of raw material, which is driven mainly by primary aluminium input. The Gränges internal process impact differences are negligible in comparison to the impact of the raw material. Figure 6 shows the breakdown on Raw Materials mix of the three different alloys. The 3003 alloy has a very low environmental impact in comparison to the other two because it uses less than 7 per cent primary aluminium. While the primary aluminium per cent of 7072 and 1100 are similar, the 1100 alloy has a 17 per cent lower carbon emission factor on raw material mix due to using much more external scrap while the 7072 alloy uses much more internal scrap.

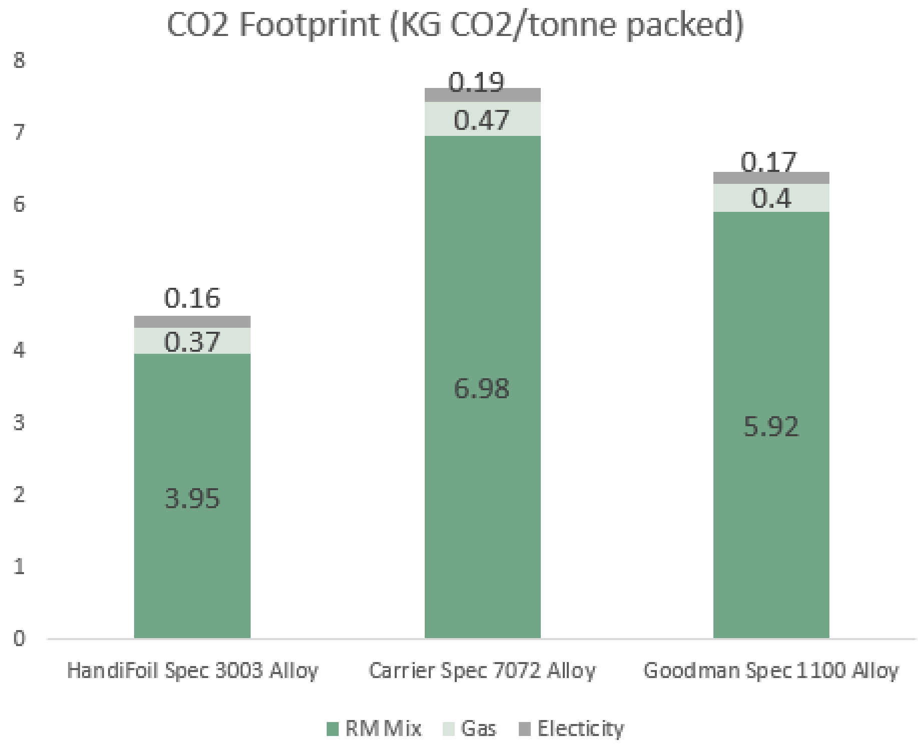

Figure 5. Carbon footprint for three selected example articles [tonnes CO_2e/tonne product].

Table 4. Raw material mix by alloy for the 3 selected articles.

Raw Material Type	1100	3003	7072
Hardner	0.41%	1.18%	0.95%
Outside Scrap	20.61%	37.64%	8.85%
Prime	54.92%	6.95%	52.21%
RSI	12.34%	10.77%	8.32%
Inside Scrap	11.72%	43.46%	29.68%
Grand Total	100.00%	100.00%	100.00%

HandiFoil Spec 3003 Alloy

HandiFoil Spec 3003 alloy has a thickness of 0.0038 inches and a slit width of 31.38 inches. The raw material mix used for internally produced cast coils is approximately 49 per cent externally recycled aluminium, 7 per cent primary aluminium ingots, and 43 per cent internal aluminium scrap. In addition, Mn alloy is added in at ~1 per cent.

As shown in Figure 5 (left bar), the total carbon footprint is 4.48 tonnes CO_2e/tonne product. Even though the share of primary aluminium ingot is relatively small in the overall raw material mix, the raw material still represents ~88 per cent of the overall carbon footprint, mainly driven by the prime usage. The internal gas and electricity usage account for the remaining 12 per cent of the footprint.

4.1 Carrier Spec 7072 Alloy

Carrier Spec 7072 alloy has a thickness of 0.0039 inches and a slit width of 36.37 inches. The raw material mix used to produce this product spec is approximately 52 per cent primary aluminium, 17 per cent recycled content, 30 per cent internal scrap and ~1 per cent Zinc alloy hardener.

As shown in Figure 5 (middle bar), the total carbon footprint is 7.6 tonnes CO_2e/tonne product. The raw material mix makes up ~92 per cent of the overall footprint and the higher primary aluminium ingot usage results in a much higher scope 3 footprint than the 3003 alloy example shown in section 4.1. The primary ingot per cent as a portion of the raw material mix is by far the biggest driver of the overall footprint and provides the biggest opportunity moving forward to replace primary aluminium with recycled content. The internal gas and electricity usage account for the remaining 8 per cent of the footprint but remains very similar to the other alloys examined.

4.2 Goodman Spec 1100 Alloy

Goodman Spec 1100 alloy has a thickness of 0.004 inches and a slit width of 41.1 inches. The raw material mix used to produce this product spec is approximately 54 per cent primary aluminium, 33 per cent recycled content, 12 per cent internal scrap and less than half a percent alloy hardener.

As shown in Figure 5 (right bar), the total carbon footprint is 6.49 tonnes CO_2e/tonne product. The raw material mix makes up ~91 per cent of the overall footprint and the higher primary aluminium ingot usage results in a much higher scope 3 footprint than the 3003 alloy example shown in section 4.1. The overall footprint is slightly lower than the 7072 footprint due to the higher recycled content and lower internal scrap per cent. As mentioned above, the internal scrap factor for each alloy is calculated as an average of the purchased raw material mix of that specific alloy. Therefore, a larger recycled content in 1100 alloy than 7072 gives a slightly lower overall scope 3 CO_2 footprint, due to the very low CO_2 footprint of purchased aluminium scrap. The internal gas and electricity usage account for the remaining 9 per cent of the footprint but remains very similar to the other alloys examined.

5 COMMUNICATION IN CARBON FOOTPRINT CERTIFICATES

The aim of Gränges' third-party verified carbon footprint certificate is to provide Gränges' customers with a credible carbon footprint assessment at product level. The certificate is valid for the specified aluminium product, and the carbon footprint for the product is communicated as a guarantee of a maximum carbon footprint, i.e. below a certain carbon footprint threshold value. This threshold value is approved annually by the President of Gränges Americas, in conjunction with the annual carbon footprint data update in the internal LCA tool, and after having assessed the range and spread of the current carbon footprint values among the products in the site's total product portfolio.

The carbon footprint certificate refers to the quality standards ISO 14040, ISO 14044, and ISO 14067 as well as the methodological choices used for Gränges' product carbon footprint assessment. It also specifies that the assessment has been third-party verified and includes a validity date and link to the third-party verification statement, which is available on Gränges' website. The certificate also includes a link to this Carbon footprint report, which can be found on Gränges' website.

Upon a customer request, the certificate is prepared and signed by the Key Account Manager (KAM) on behalf of the President for Gränges Americas. The KAM is responsible to retrieve the product information as well as the applicable carbon footprint threshold from the internal CF tool.

6 CONCLUSIONS AND RECOMMENDATIONS

The following main conclusions can be drawn from the carbon footprint modelling and data;

- There are no real standards in the rolled aluminium industry on how to calculate and allocate carbon footprint. This report can hopefully contribute to such industry standardization and thereby enable comparability in carbon footprint assessments between products and suppliers.
- Allocation of carbon footprint to scrap generated in the process is a challenge, especially when closed loop recycling cannot be used, i.e. when the scrap cannot be recycled back to the same product specification that generated it. Scrap consuming alloys could be regarded as unfairly punished by the chosen allocation method. Further work can be required.
- The main drivers for reduced carbon footprint and carbon intensity are:
    - Sourcing of more external aluminium scrap

    - Sourcing of low-carbon primary aluminium
- Process related drivers have much less influence on the carbon footprint than metal related drivers when low carbon energy sources are used. Still, the most important ones are:
    - Reducing energy intensity in own operations.
    - Increasing the use of renewable energy in own operations.

Recommendations to further work;

- Extend the impact categories in addition to carbon footprint.
- Extend the modelling to other plants in addition to Gränges Americas.
- Analyse further the need for an improved allocation model for internal process scrap.

7 REFERENCES

EN ISO 14040. Environmental management – Life cycle assessment – Principles and framework. ISO 14040:2006

EN ISO 14044. Environmental management – Life cycle assessment – Requirements and guidelines. ISO 14044:2006

ISO 14067. Greenhouse gases -- Carbon footprint of products -- Requirements and guidelines for quantification and communication. ISO 14067:2018

8 APPENDIX 1

Gränges' carbon footprint (CF) tool is built in the spreadsheet software Excel. It aims to automatically calculate the environmental impacts of the company's products and articles, initially covering the product carbon footprint. The following tabs are included in the Excel sheet to allow for calculation of carbon footprint for individual articles in the 'Intensity_Calc' tab.

NR	TAB	DESCRIPTION	SOURCES
1	Intensity_Calc	This is the main tab in which all the different intensity sources are summed up and the total intensity per spec is calculated	Reference Tables tab, RM Usage Data, MWH MMBTU Pivot, HRM Data Pivoted
2	Intensity_Pivot	This is a summarized editable version of the intensity calc tab	Intensity Hardcoded Data
3	Intensity_Hardcoded_Data	This is just the hardcoded version of the Intensity Calc tab to fuel the pivot table.	Intensity Calc tab
4	Reference_Tables	Shows the allocations per machine of MWh and MMBTU and where we log the total plant-wide usage of MWh and MMBTU to allocate out to the	Everything here is sourced from Jana Barger's (HRM Plant Controller) monthly allocations file that she uses to distribute

		machines. We also have the electricity and natural gas intensity factors along with the external reroll intensities.	energy costs to different work centers/machines. The electricity and natural gas factors come from Chad Pinson, the external reroll factors come from Mark Lienhart.
5	Casted_Coil_Sources	Here is where we list each spec and the casted coil source. So, we need to know what % of lbs had an internal source vs ASAS vs Hot Springs so we can apply the right carbon intensity. Sourced from the manufacturing Data for HRM	This is sourced from our customer margins database where all the manufacturing data is gathered (mfng_data_HRM table name).
6	Alloy_Emission_Calculation	This is where we calculate the total intensity per alloy	RM Usage Data
7	RM_Usage_Data	Our internal raw material database where we store the charge information and what % of scrap, prime and other material went into that charge.	Data_Mart database
8	MWH_MMBTU_Pivot	Hours Per Machine Per Packed Spec. We take the hours per spec per machine and divide that by the total hours for that machine. Then we multiply it by the total mmbtu for that machine to get the mmbtu used by that spec for that month on that machine. Same thing for Electricity MWh. This pulls into the "Intensity Calc" tab. Sourced from the HRM Data Pivoted tab	HRM_Data_Pivoted
9	HRM_Data Pivoted	A pivoted version of our HRM Timing Data. We have this tab just to make the building of formulas easier.	HRM Timing Data
10	HRM_Timing_Data	The time spent per spec on each machine, sourced from the manufacturing data for HRM	This is sourced from our customer margins database where all the manufacturing data is gathered (mfng_data_HRM table name).
11	Machine_List	Just a list of the machines in our database and the	Itself

	cost centers their associated with. We do not necessarily log all energy usage by machine, but some by overall work centers. So, for example we do not separate out the energy usage by each caster, but by the group of casters in our west, then east plants.	