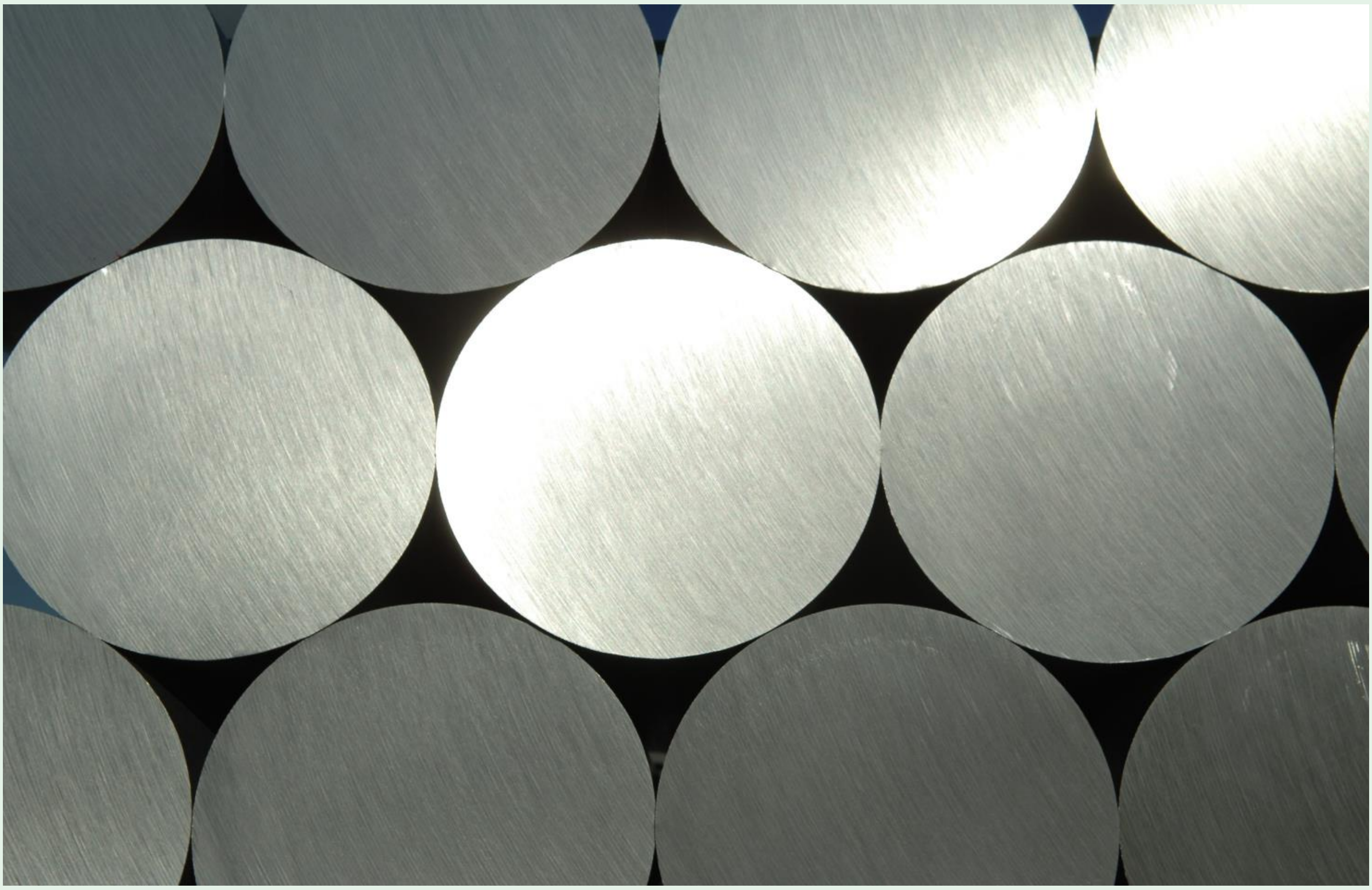
# Environmental Product Declaration

In accordance with 14025 and EN15804 +A2

## Hydro CIRCAL 100R, Aluminium Extrusion Ingot



The Norwegian
EPD Foundation

**Owner of the declaration:**
Hydro Aluminium AS
Drammensveien 264, N-0283 Oslo
www.hydro.com

**Product name:**
Hydro Aluminium Metal Extrusion Ingot CIRCAL 100R

**Declared unit:**
1 kg Aluminium extrusion ingot from the Azuqueca, Clervaux, and Wrexham aluminium recycling plants.

**Product category /PCR:**
NPCR 013, "Version 3.0 Part B for steel and aluminium construction products" and NPCR Part A: Construction Products and Services Version 2.0

**Program holder and publisher:**
The Norwegian EPD foundation

**Declaration number:**
NEPD-6066-5328-EN

**Registration Number:**
NEPD-6066-5328-EN

**Issue date:**
13.02.2024

**Valid to:**
13.02.2029

# General information

## Product:
Hydro Aluminium CIRCAL 100R Extrusion Ingot

## Program Operator:
The Norwegian EPD Foundation
Post Box 5250 Majorstuen, 0303 Oslo, Norway
Phone: +47 23 08 80 00
e-mail: post@epd-norge.no

## Declaration Number:
NEPD-6066-5328-EN

## This declaration is based on Product Category Rules:
CEN Standard EN 15804 serves as core PCR
NPCR 013, "Version 3.0 Part B for steel and aluminium construction products" 2021
NPCR Part A: Construction Products and Services Version 2.0:2021

## Statements:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturer, life cycle assessment data and evidence.

## Declared unit:
1 kg CIRCAL Aluminium extrusion ingot 100R from the Azuqueca, Clervaux, and Wrexham aluminium recycling plants.

## Declared unit with option:
Includes modules: A1-A4, C1-C4, and D

## Verification:
Independent verification of the declaration and data, according to ISO14025:2010
internal ☐ external ☐

Sign
Linda Høibye
Life Cycle Assessment Consulting
Independent verifier approved by EPD Norway

## Owner of the declaration:
Hydro Aluminium As
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## Manufacturer:
Hydro Aluminium As
Drammensveien 264, N-0283 Oslo
Phone: +47 22538100
e-mail: greener.aluminium@hydro.com

## Place of production:
Hydro Clervaux- Luxembourg ; Hydro Azuqueca-Spain ; Hydro Wrexham- Wales

## Management system:
ISO 14001, ISO 9001, ISO 50001, 45001

## Organisation no:
917537534

## Issue date:
13.02.2024

## Valid to:
13.02.2029

## Year of study:
[xxxx]

## Comparability:
EPDs from other programmes than [Name of Program operator] may not be comparable.

## This average EPD has been worked out by:
Valentina Pauna, Andreas Brekke, and Maciej Biedacha, all from NORSUS AS

Approved Håkon Hauan

Manager of EPD Norway

# Product/Process

**Hydro Aluminium Extrusion Ingot from Hydro Aluminium Metal**
Norsk Hydro ASA is the mother company of Hydro Energy and Hydro Aluminium AS. The latter is divided into Hydro Bauxite and Alumina, Hydro Aluminium Metal, and Hydro Extrusions. Hydro Aluminium Metal is a leading supplier of cast house products from a global network of cast houses supplied in the form of extrusion ingots, sheet ingots, foundry alloys, forging ingots and wire rods with a total volume of around 3 million metric tons per year.

The production sites for products of primary aluminium are:

- Sunndalsøra, Norway: Extrusion Ingots, Foundry Alloys
- Karmøy, Norway: Extrusion Ingots, Wire Rod
- Husnes, Norway: Extrusion Ingots, Forging Ingots
- Årdal, Norway: Sheet Ingots, Foundry Alloys
- Høyanger, Norway: Sheet Ingots
- Slovalco, Slovakia: Extrusion Ingots, Foundry Alloys
- Qatalum, Qatar: Extrusion Ingots, Foundry Alloys
- Albras, Brazil: Foundry Alloys, Standard Ingots

The production sites for products of recycled aluminium are:

- Rackwitz, Germany: Extrusion Ingots, Forging Ingots
- Clervaux, Luxembourg: Extrusion Ingots
- Luce, France: Extrusion Ingots
- Wrexham, UK: Extrusion Ingots
- Azuqueca, Spain: Extrusion Ingots
- Commerce, TX USA: Extrusion Ingots
- Henderson, KY USA: Extrusion Ingots
- Cassopolis, MI USA: Extrusion Ingots

**Hydro CIRCAL 100R**
Hydro CIRCAL 100R is Extrusion Ingots tailormade for the circular economy with a Post Consumer Scrap (also denoted End of Life Scrap) content of at least 99,5%. See link for more info:

Hydro CIRCAL 100R | Near-zero carbon aluminium made with 100% post-consumer scrap - YouTube

Most of the Post-Consumer scrap used are shredded and sorted to remove all foreign materials to ensure a close to 100% aluminium fraction. See figure 1 and 2, and link for an illustrative video of the process:

How Is Aluminium Recycled? - YouTube

The shredded scrap is further treated in the cast house through an innovative and energy efficient process in which the scrap goes through a de-lacquering process. Here, the organic content is removed through pyrolysis in which a hot gas at 500 degrees burns off the paint.

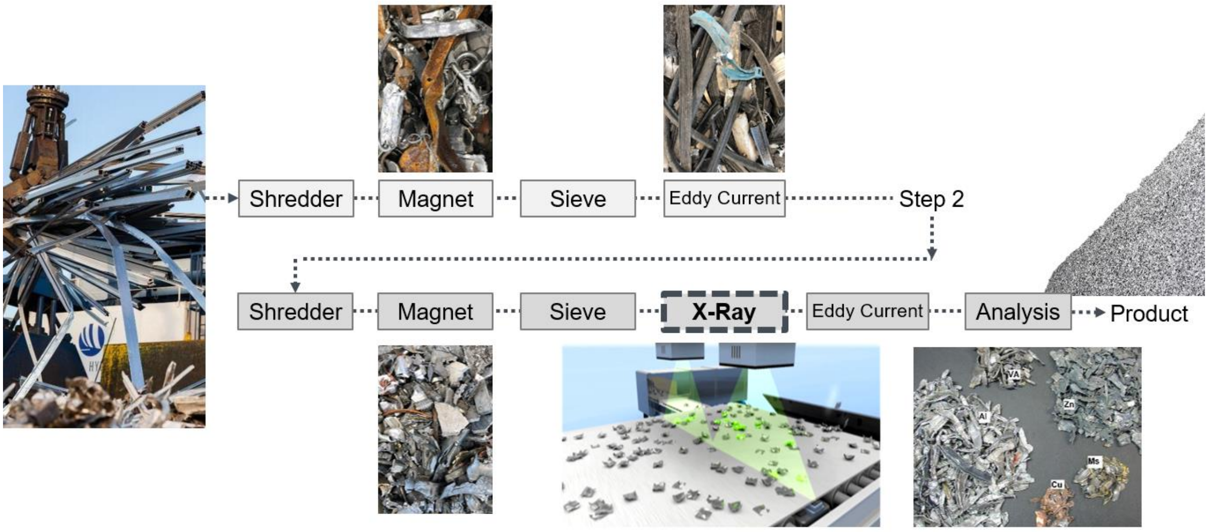


Figure 1: *Illustration of typical shredding and sorting process of extruded aluminium end of life scrap.*


Figure 2: *Shredded and sorted post-consumer scrap ready for remelting into new CIRCAL 100R extrusion ingots.*

To ensure traceability of the post-consumer scrap used to produce Hydro CIRCAL 100R procedures are developed including auditing of suppliers, intake control and segregation of the scrap through the production process. This is documented batch by batch through the production system. The procedures, documentation and processes are verified annually by third party certification body DNV.

Recycling requires only 5% of the energy required for production of primary metal (Hydro, 2023). Hence, the direct and indirect emissions from plants recycling aluminium are small in comparison to emissions connected to the production of primary aluminium. In addition, indirect emissions from raw materials are minimal when recycling waste as post-consumer scrap with zero impact that has gone through its useful life and are recycled back into new products,. As a result, the impact on CIRCAL 100R on climate change (GWP-Total in kg CO2/kg Al) is minimal as compared to other aluminium production routes (fig. 3) being 32x below the global average for primary aluminium and 12x below the European average.

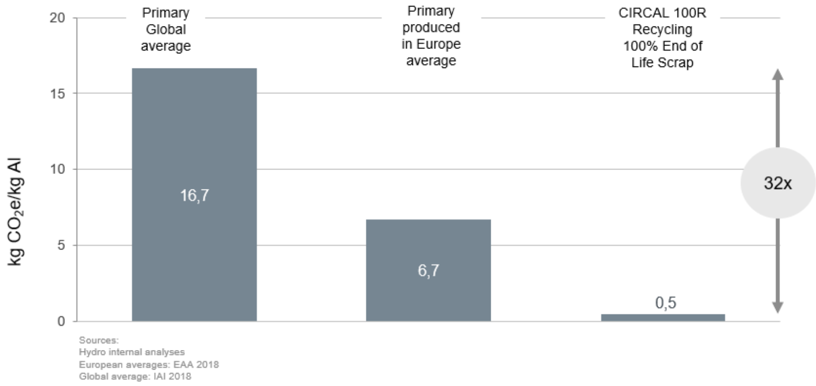


Figure 3: *Climate impact of aluminium from different production routes*

The contribution from different factors to impacts on climate change (GWP-Total in kg $CO_2$/kg Al) for CIRCAL 100R is shown in Fig. 4.

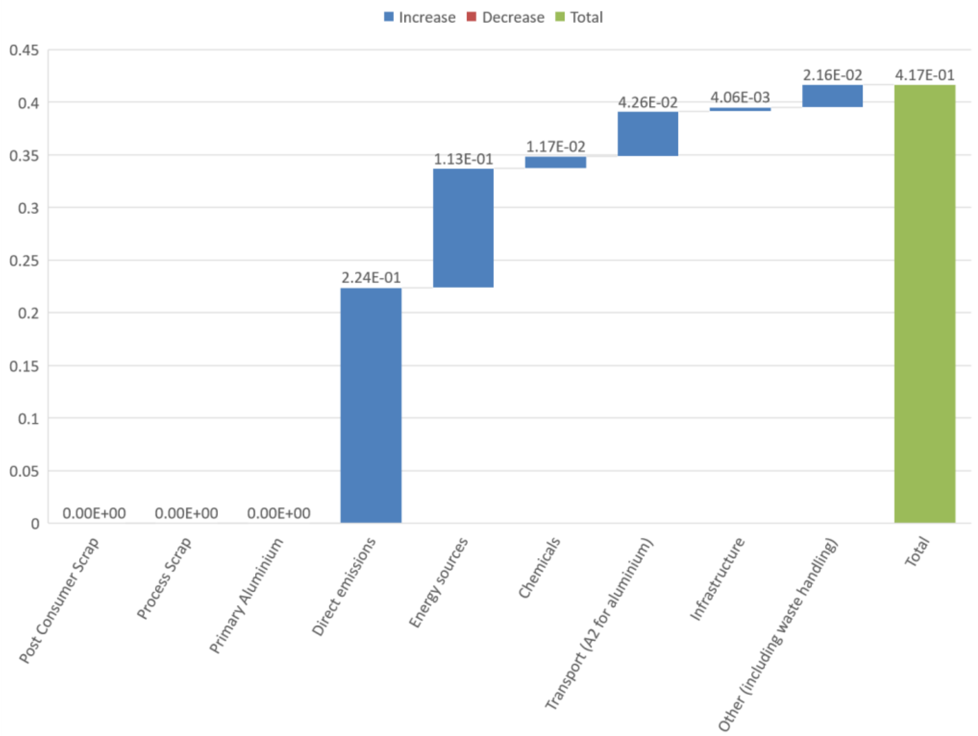


Figure 4*: A waterflow diagram showing the contributions to climate change (GWP-Total in kg $CO_2$/kg Al) for CIRCAL 100R for modules A1-A3.*

The reason why post-consumer scrap has no contribution is that this scrap is modelled as waste without environmental impacts except for transport between the handling site for used aluminium and the recycled aluminium plant. This is included in the bar called Transport (A2 for aluminium). No process scrap or primary aluminium is added to 100R.

CIRCAL 100R may be produced at the Hydro Aluminium Metal Recycling cast houses in: Clervaux, Luxembourg; Azuqueca, Spain; Deeside, UK or Luce, France.

## Product specification:

Cast aluminium products contain alloying materials  and these are designated different numbers depending on what materials they contain which also give specific product characteristics. Most of the Extrusion Ingots produced belong to the 6000 alloy family from all major alloy groups with compositions shown in table 1.  All products are produced according to EN 486:2009.

https://www.hydro.com/en/aluminium/products/casthouse-products/extrusion-ingots/

*Table 1 Chemistry of selected alloys within the 6000 alloy family.*

| Alloy | Mg | Mn | Fe | Si | Cu | Zn | Cr | Ti | Other | Al |
|---|---|---|---|---|---|---|---|---|---|---|
| 6005A | 0.4-0.7 | ≤0.50 | ≤0.35 | 0.5-0.9 | ≤0.30 | ≤0.20 | ≤0.30 | ≤0.10 | ≤0.05 | Rest |
| 6060 | 0.35-0.6 | ≤0.10 | 0.10-0.30 | 0.3-0.6 | ≤0.10 | ≤0.15 | ≤0.05 | ≤0.10 | ≤0.05 | Rest |
| 6061 | 0.8-1.2 | ≤0.15 | ≤0.7 | 0.4-0.8 | 0.15-0.40 | ≤0.25 | 0.04-0.35 | ≤0.15 | ≤0.05 | Rest |
| 6063 | 0.45-0.9 | ≤0.10 | ≤0.35 | 0.2-0.40 | ≤0.10 | ≤0.10 | ≤0.10 | ≤0.10 | ≤0.05 | Rest |
| 6082 | 0.6-1.2 | 0.4-1.0 | ≤0.50 | 0.7-1.3 | ≤0.10 | ≤0.20 | ≤0.25 | ≤0.10 | ≤0.05 | Rest |
| 6106 | 0.4-0.8 | 0.05-0.2 | ≤0.35 | 0.3-0.6 | ≤0.25 | ≤0.15 | ≤0.20 | ≤0.10 | ≤0.05 | Rest |

This EPD covers all the alloys described in the table, where the differences in environmental impacts between the variou alloys are negligible (<1%) in the final products because of small variations in the amounts of alloying elements between the different groups.

## Technical data:

Typical technical properties for the alloys covered by this EPD are shown in table 2.

*Table 2 Technical properties for the extrusion ingot aluminium alloys covered in this EPD.*

| Name | Typical Values 6xxx alloys | Unit |
|---|---|---|
| **Density** | 2.66 – 2.71 | (Kg/m³) * 10³ |
| **Melting point (Typical)** | 575-655 | °C |
| **Electrical conductivity (Typical) at 20°C/at 68°F** | Equal Volume: 22-36 | MS/m (0.58*%IACS) |
| **Thermal conductivity (Typical) at 25°C/at 77°F** | 130-220 | W/(m*k) |
| **Average Coefficient of thermal expansion (Typical) 20° to 100°C/68° to 212°F** | 19.4-24.1 | Per °C |
| **Modulus of elasticity (Typical)** | 69-72 | GPa |
| **Chemical composition** | Varying alloy by alloy, most case Al > 98 | % by mass |

## Market:

The CIRCAL 100R product covered in this EPD has all of Europe as its main market. The main portion goes to building and construction, but it is also employed in other sectors (general engineering, solar panels, the automotive industry, transport, and consumer goods).

# LCA: Calculation rules

## Declared unit:

1 kg of CIRCAL 100R aluminium extrusion ingot manufactured at the Azuqueca, Clervaux, and Wrexham aluminium recycling plants.

The CIRCAL product is produced in more than one location. This product is therefore made as a weighted average between the three locations Azuqueca (Spain), Clervaux (Luxembourg) and Wrexham (England). These three locations have different power input, namely the market mix in each individual country, but the mix of metal sources is more important for the environmental impacts, and we see these products as interchangeable between the countries.

## Data quality:

The data quality for the foreground system is very good with specific data for the year 2021 for all inputs and outputs from the recycling plant. The data quality is good for all the main material input which is primary aluminium and pre- and post-consumer scrap from specific suppliers. Data for the background system are mainly from ecoinvent 3.8 (Wernet et al. 2016 and Ecoinvent 2022) as implemented in the software SimaPro, version 9.3 (Pré 2022). Some data for background systems have also been collected and implemented in the model as part of the project.

## Allocation:

The allocation is made in accordance with the provisions of EN 15804. Infrastructure of the plant, incoming energy, water and waste production in-house is allocated equally among all products (conversion volumes, full price/direct sales, CIRCAL 75R, CIRCAL 100R) through mass allocation. Allocation between aluminium hydroxide and aluminium oxide in the production of alumina for primary metal added in the process are done through economic allocation. The potential environmental impacts from production of primary aluminium are not transferred to post-consumer recycled aluminium. Only the recycling process and transportation of the material is allocated to the post-consumer scrap used for the aluminium at the aluminium recycling plants producing CIRCAL 100R. Fig. 5 shows the incoming materials to the recycling plant and the return of materials from customers.

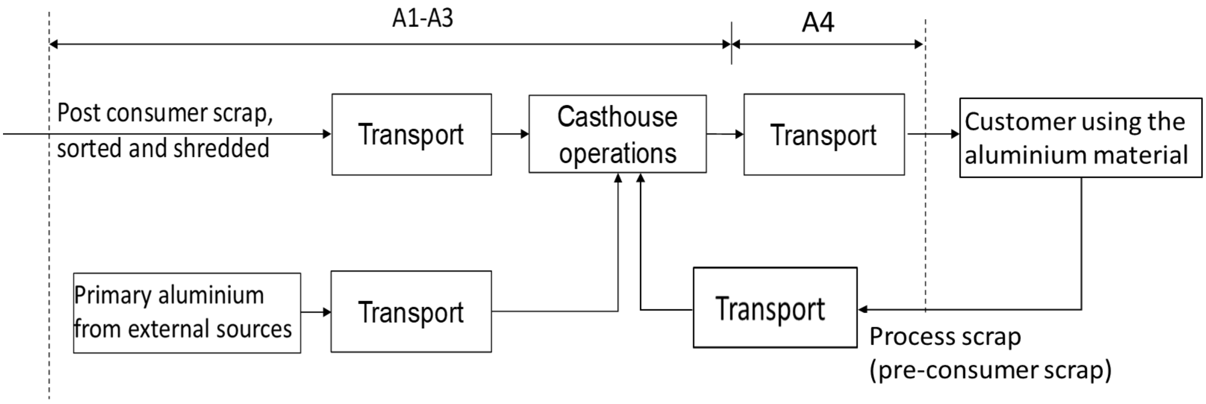


*Fig. 5 Flow sheet for modules A1 – A4 for 1 kg of aluminium extrusion ingot from aluminium recycling plant.*

At the far left of the figure, where post-consumer scrap and primary aluminium is entering the process (from module A1), there are several different suppliers of both post-consumer scrap and primary aluminium. The names of these are not disclosed here for reasons of confidentiality. At the far right, there is an arrow with process scrap going back to cast house operations. This flow is modelled as 'closed loop' recycling, in other words it contains the embodied impacts of the initial material.

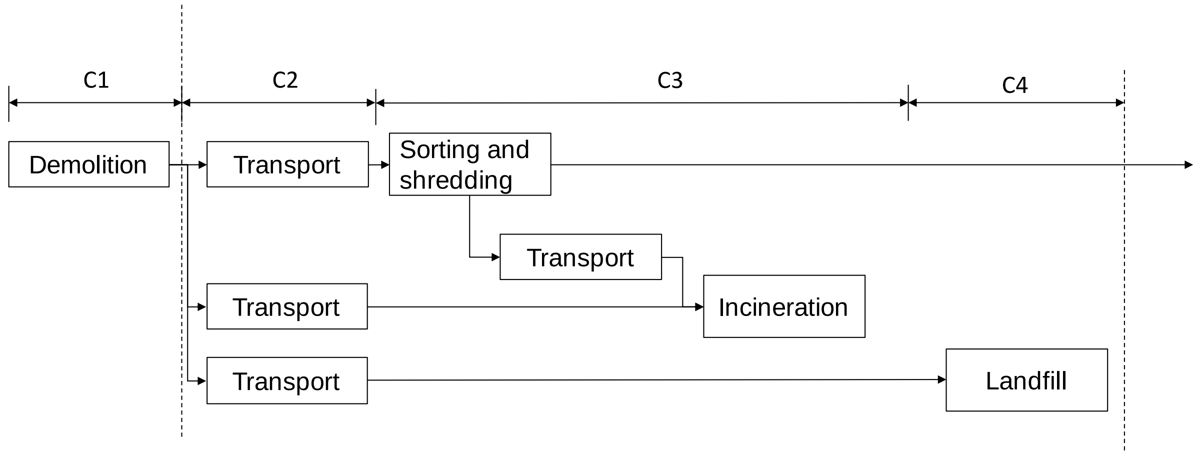


*Fig. 6 Flow sheet for modules C1 – C4 for 1 of aluminium extrusion ingot after end of useful life. C1 is included but assumed negligible because the material and energy used to dismantle or demolish extruded aluminium is typically insignificant.*

## System boundary:

Cradle to gate with options. The following stages have been declared: A1-A4, C1-C4, and D. Further specified in the flow sheets shown in figure 2 and figure 3. Sub module A5 and all modules under B are not declared in this EPD as the extrusion ingot are used for many different applications where these sub modules will vary to the extent that making an average scenario is nonsensical.

Module D covers the potential benefits from recycling of CIRCAL 100R Aluminium Extrusion Ingot after end of useful life. Module D covers all necessary processes from C3 until the aluminium is back on the market and can be compared to the environmental performance of an average market aluminium extrusion ingot. The module is further specified in the section LCA: Scenarios and additional technical information.

## Cut-off criteria:

All major raw materials and all the essential energy is included. Detailed production process for raw materials and both renewable and non-renewable energy flows that are included with very small amounts (<1%) are not included.

When applying the cut-off criteria for this EPD, mass and energy flows have been gathered for the entire production system and all processes in the foreground system including A1 to A4. Cut-off has only been applied to module C1 where it is assumed that renewable and non-renewable energy and material use is less than 1% of total use of materials, that none of these are hazardous and does not contribute to significant environmental impacts. The total exclusion of mass and energy flows is well below 5% per module and for the system in total.

# LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

## Transport from production place to assembly/user (A4)

The transport from the production sites for CIRCAL to the average customer location in Europe, based on lorry. The average distance is approximately 200 km. Values for capacity utilisation and fuel consumption is gathered from Hydro in 2022 with data from 2021 and ecoinvent (2016, updated 2022) as shown in Table 3.

Table 3 Specification of theimportant parameters for the A4 module.

| Type | Capacity utilisation (incl. return) % | Type of vehicle | Distance KM | Fuel/Energy consumption value (l/tkm) |
|---|---|---|---|---|
| Truck | 50 | Lorry, >32 metric tons, Euro V | 200 | 1.63E-02 |

## End of Life (C1, C3, C4)

After end of useful life, most of the aluminium used for construction purposes is collected (approximately 96%) and recycled (approximately 97% of the collected aluminium), giving a total of 93% recycled aluminium. The aluminium is transported to a material processing site where different materials are sorted and sent to recycling. Hydro has a DNV certified process in the recycling plants and therefore closed loop recycling is assumed for pre-consumer scrap, and open loop recycling to the same facility for the post-consumer scrap. Table 4 shows the material flows at the end of life for the product.

Table 4 The material flows of the fate of the product after end of useful life.

| | Unit | Value |
|---|---|---|
| Hazardous waste disposed | kg | 0 |
| Collected as mixed construction waste | kg | 0.96 |
| Reuse | kg | 0 |
| Recycling | kg | 0.933 |
| Energy recovery | kg | 0.027* |
| To landfill | kg | 0.04** |

* 27 grams of the original 1 kilogram of aluminium is going to incineration. No loads or benefits are attributed to this flow.

** There will be a small portion of extruded aluminium ending as aggregate at the construction site. This is included under "To landfill" where no loads or benefits are included.

## Transport to waste processing (C2)

Transport back to waste processing after end-of-useful life is modelled based on real distances to Hydro facilities and data from ecoinvent (Hydro 2022 and ecoinvent 2016/2022) as shown in

Table 5.

Table 5 Important parameters for the specification of module C2 for the product.

| Type | Capacity utilisation (incl. return) % | Type of vehicle | Distance KM | Fuel/Energy consumption value (l/tkm) |
|---|---|---|---|---|
| Truck | 50 | Lorry, >32 metric tons, Euro V | 269 | 2.42E-02 |

Aluminium from the shredder to waste handling site is assumed to be transported in an older medium-sized lorry with smaller capacity utilization than in the production system.

### Benefits and loads beyond the system boundaries (D)

Aluminium collected and recycled is assumed to replace a virgin aluminium product representing the European average primary aluminium used for extrusion ingot. The flow of material being sent to recycling and the actual amount of primary aluminium being substituted is shown in Table 6.

Table 6 The flow of material that replaces primary material in other life cycles.

| | Unit | Value |
|---|---|---|
| Aluminium extrusion ingot to material recycling | g | 0 |
| Aluminium extrusion ingot recycled and substituting primary aluminium | g | 0 |

The initial content of secondary material is not included in the calculations for module D, therefore no material is used in the calculations as sent to recycling and no loads or benefits are given for this product outside the system boundaries of the first life cycle.

## LCA: Results

All results are calculated with the use of SimaPro v.9.4 (2022) and impact methods according to ISO 15804+A2:2019.

### System boundaries (X=included, MND= module not declared, MNR=module not relevant)

| Product stage | | | Assembly stage | | Use stage | | | | | | | End of life stage | | | | Benefits & loads beyond system boundary |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw materials | Transport | Manufacturing | Transport | 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 | X | MNR | MNR | MNR | MNR | MNR | MNR | MNR | MNR | X | X | X | X | X |

## Core environmental impact indicators

| Indicator | Unit | A1-A3 | A4 | C1* | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|
| GWP-total | kg CO2 eq. | 4.17E-01 | 1.74E-02 | 0 | 2.54E-02 | 2.50E-01 | 6.14E-04 | 0.00E+00 |
| GWP-fossil | kg CO2 eq. | 4.14E-01 | 1.74E-02 | 0 | 2.54E-02 | 2.46E-01 | 5.24E-04 | 0.00E+00 |
| GWP-biogenic | kg CO2 eq. | 2.03E-03 | 1.85E-05 | 0 | 2.70E-05 | 3.30E-03 | 9.04E-05 | 0.00E+00 |
| GWP-LULUC | kg CO2 eq. | 3.94E-04 | 6.53E-06 | 0 | 9.54E-06 | 1.15E-04 | 1.69E-07 | 0.00E+00 |
| ODP | kg CFC11 eq. | 1.21E-08 | 4.34E-09 | 0 | 6.33E-09 | 9.71E-09 | 1.49E-10 | 0.00E+00 |
| AP | mol $H^+$ eq. | 1.42E-03 | 5.54E-05 | 0 | 8.08E-05 | 8.10E-04 | 4.24E-06 | 0.00E+00 |
| EP-freshwater | kg P eq. | 5.64E-05 | 1.24E-07 | 0 | 1.81E-07 | 9.05E-06 | 6.00E-09 | 0.00E+00 |
| EP-marine | kg N eq. | 4.98E-04 | 1.22E-05 | 0 | 1.78E-05 | 8.98E-05 | 1.58E-06 | 0.00E+00 |
| EP-terrestrial | mol N eq. | 5.40E-03 | 1.36E-04 | 0 | 1.97E-04 | 1.12E-03 | 1.78E-05 | 0.00E+00 |
| POCP | kg NMVOC eq. | 1.85E-03 | 5.34E-05 | 0 | 7.78E-05 | 3.21E-04 | 5.04E-06 | 0.00E+00 |
| ADP-M&M | kg Sb eq. | 8.67E-07 | 4.16E-08 | 0 | 6.12E-08 | 7.46E-06 | 2.81E-09 | 0.00E+00 |
| ADP-fossil | MJ | 6.50E+00 | 2.83E-01 | 0 | 4.13E-01 | 1.45E+00 | 1.23E-02 | 0.00E+00 |
| WDP | $m^3$ | 3.16E-02 | 9.74E-04 | 0 | 1.42E-03 | 1.47E-02 | 6.63E-05 | 0.00E+00 |

***GWP-total:*** *Global Warming Potential;* ***GWP-fossil:*** *Global Warming Potential fossil fuels;* ***GWP-biogenic:*** *Global Warming Potential biogenic;* ***GWP-LULUC:*** *Global Warming Potential land use and land use change;* ***ODP:*** *Depletion potential of the stratospheric ozone layer;* ***AP:*** *Acidification potential, Accumulated Exceedance;* ***EP-freshwater:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment; See "additional Norwegian requirements" for indicator given as PO4 eq.* ***EP-marine:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment;* ***EP-terrestrial:*** *Eutrophication potential, Accumulated Exceedance;* ***POCP****: Formation potential of tropospheric ozone;* ***ADP-M&M****: Abiotic depletion potential for non-fossil resources (minerals and metals);* ***ADP-fossil:*** *Abiotic depletion potential for fossil resources;* ***WDP:*** *Water deprivation potential, deprivation weighted water consumption*

* C1 is assumed negligible, and the value is therefore set equal to zero. To show the uncertainty for this assumption, no decimals are used.

## Additional environmental impact indicators

| Indicator | Unit | A1-A3 | A4 | C1* | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|
| PM | Disease incidence | 1.15E-08 | 2.02E-09 | 0 | 2.93E-09 | 1.40E-08 | 8.67E-11 | 0.00E+00 |
| IRP | kBq U235 eq. | 2.60E-02 | 1.23E-03 | 0 | 1.79E-03 | 3.42E-03 | 8.33E-05 | 0.00E+00 |
| ETP-fw | CTUe | 9.93E-01 | 2.21E-01 | 0 | 3.23E-01 | 5.88E+00 | 2.48E+01 | 0.00E+00 |
| HTP-c | CTUh | 1.43E-10 | 6.03E-12 | 0 | 8.82E-12 | 1.56E-10 | 1.15E-12 | 0.00E+00 |
| HTP-nc | CTUh | 2.91E-09 | 2.33E-10 | 0 | 3.39E-10 | 6.75E-09 | 2.11E-11 | 0.00E+00 |
| SQP | Dimensionless | 2.48E+00 | 3.24E-01 | 0 | 4.70E-01 | 1.43E+00 | 2.57E-02 | 0.00E+00 |

***PM:*** *Particulate matter emissions;* ***IRP:*** *Ionising radiation, human health;* ***ETP-fw:*** *Ecotoxicity (freshwater);* ***ETP-c:*** *Human toxicity, cancer effects;* ***HTP-nc:*** *Human toxicity, non-cancer effects;* ***SQP:*** *Land use related impacts / soil quality*
* C1 is assumed negligible, and the value is therefore set equal to zero. To show the uncertainty for this assumption, no decimals are used.

## Classification of disclaimers to the declaration of core and additional environmental impact indicators

| ILCD classification | Indicator | Disclaimer |
|---|---|---|
| ILCD type / level 1 | Global warming potential (GWP) | None |
| | Depletion potential of the stratospheric ozone layer (ODP) | None |
| ILCD type / level 2 | Potential incidence of disease due to PM emissions (PM) | None |
| | Acidification potential, Accumulated Exceedance (AP) | None |
| | Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine) | None |
| | Eutrophication potential, Accumulated Exceedance (EP-terrestrial) | None |
| | Formation potential of tropospheric ozone (POCP) | None |
| | Potential Human exposure efficiency relative to U235 (IRP) | 1 |
| ILCD type / level 3 | Abiotic depletion potential for non-fossil resources (ADP-minerals&metals) | 2 |
| | Abiotic depletion potential for fossil resources (ADP-fossil) | 2 |
| | Water (user) deprivation potential, deprivation-weighted water consumption (WDP) | 2 |
| | Potential Comparative Toxic Unit for ecosystems (ETP-fw) | 2 |
| | Potential Comparative Toxic Unit for humans (HTP-c) | 2 |
| | Potential Comparative Toxic Unit for humans (HTP-nc) | 2 |
| | Potential Soil quality index (SQP) | 2 |
| **Disclaimer 1** – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator. | | |
| **Disclaimer 2** – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator | | |

## Resource use

| Indicator | Unit | A1-A3 | A4 | C1* | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|
| RPEE | MJ | 2.29E-01 | 3.61E-03 | 0 | 5.28E-03 | 1.99E-01 | 2.29E-03 | 0.00E+00 |
| RPEM | MJ | 0.00E+00 | 0.00E+00 | 0 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TPE | MJ | 2.29E-01 | 3.61E-03 | 0 | 5.28E-03 | 1.99E-01 | 2.29E-03 | 0.00E+00 |
| NRPE | MJ | 6.50E+00 | 2.83E-01 | 0 | 4.13E-01 | 1.45E+00 | 1.23E-02 | 0.00E+00 |
| NRPM | MJ | 0.00E+00 | 0.00E+00 | 0 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TRPE | MJ | 6.50E+00 | 2.83E-01 | 0 | 4.13E-01 | 1.45E+00 | 1.23E-02 | 0.00E+00 |
| SM | kg | 1.13E+00 | 0.00E+00 | 0 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF | MJ | 0.00E+00 | 0.00E+00 | 0 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF | MJ | 0.00E+00 | 0.00E+00 | 0 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| W | $m^3$ | 9.61E-04 | 3.37E-05 | 0 | 4.91E-05 | 8.09E-04 | 1.78E-05 | 0.00E+00 |

***RPEE** Renewable primary energy resources used as energy carrier; **RPEM** Renewable primary energy resources used as raw materials; **TPE** Total use of renewable primary energy resources; **NRPE** Non-renewable primary energy resources used as energy carrier; **NRPM** Non-renewable primary energy resources used as materials; **TRPE** Total use of non-renewable primary energy resources; **SM** Use of secondary materials; **RSF** Use of renewable secondary fuels; **NRSF** Use of non-renewable secondary fuels; **W** Use of net fresh water*

* C1 is assumed negligible, and the value is therefore set equal to zero. To show the uncertainty for this assumption, no decimals are used.

## End of life - Waste

| Indicator | Unit | A1-A3 | A4 | C1* | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|
| HW | kg | 1.53E-03 | 6.85E-07 | 0 | 1.00E-06 | 6.17E-03 | 1.51E-08 | 0.00E+00 |
| NHW | kg | 1.91E-01 | 2.81E-02 | 0 | 4.08E-02 | 1.25E+00 | 8.22E-02 | 0.00E+00 |
| RW | kg | 6.63E-06 | 1.92E-06 | 0 | 2.80E-06 | 4.25E-06 | 8.49E-08 | 0.00E+00 |

***HW** Hazardous waste disposed; **NHW** Non-hazardous waste disposed; **RW** Radioactive waste disposed.*

* C1 is assumed negligible, and the value is therefore set equal to zero. To show the uncertainty for this assumption, no decimals are used.

## End of life – output flow

| Indicator | Unit | A1-A3 | A4 | C1* | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|
| CR | kg | 0.00E+00 | 0.00E+00 | 0 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MR | kg | 1.00E+00 | 0.00E+00 | 0 | 0.00E+00 | 9.33E-01 | 0.00E+00 | 0.00E+00 |
| MER | kg | 0.00E+00 | 0.00E+00 | 0 | 0.00E+00 | 2.56E-02 | 0.00E+00 | 0.00E+00 |
| EEE | MJ | 1.66E-04 | 0.00E+00 | 0 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| ETE | MJ | 2.98E-04 | 0.00E+00 | 0 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

***CR** Components for reuse; **MR** Materials for recycling; **MER** Materials for energy recovery; **EEE** Exported electric energy; **ETE** Exported thermal energy.*

* C1 is assumed negligible, and the value is therefore set equal to zero. To show the uncertainty for this assumption, no decimals are used.

Reading example for scientific notation: 9.0 E-03 = 9.0*10-3 = $9.0*10^{-3}$ = 0.009

### Information describing the biogenic carbon content at the factory gate

| Biogenic carbon content | Unit | Value |
|---|---|---|
| Biogenic carbon content in product | kg C | 0 |
| Biogenic carbon content in the accompanying packaging | kg C | 0 |

# Additional requirements

### Greenhouse gas emission from the use of electricity in the manufacturing phase

National production mix from import, low voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing process A3 as calculated from ecoinvent 3.8. In addition, the residual electricity mix is reported as given in AIB (2022), except for UK which is given in Carbon Footprint (2023).

| Geographical location | National electricity mix [kg CO2 -eq/kWh] | Residual electricity mix [kg CO2 -eq/kWh] | Electricity used in foreground system [kWh/kg product] | Difference in GWP-total for A1-A3 [kg CO2-eq] |
|---|---|---|---|---|
| Spain | 0.33 | 0.3 | 0.13 | -3.90E-03 |
| Luxembourg | 0.53 | 0.4 | 0.089 | -1.16E-02 |
| UK | 0.31 | 0.35 | 0.1 | 4.00E-03 |
| Average | 0.39 | 0.35 | 0.11 | -3.82E-03 |

The fact that the value for the national electricity mix is higher than the residual electricity mix for three of five locations shows that using different data sources for these electricity mixes can make non-sensical results. The result for GWP-total would *decrease* with 3.82e-03 if values for the contribution to climate change for residual electricity mix is used instead of the values for the national electricity mix.

### Additional environmental impact indicators required in NPCR Part A for construction products

In order to increase the transparency of biogenic carbon contribution to climate impact, the indicator GWP-IOBC is required as it declares climate impacts calculated according to the principle of instantaneous oxidation. GWP-IOBC is also referred to as GWP-GHG in context to Swedish public procurement legislation.

| Indicator | Unit | A1-A3 | A4 | C1* | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|
| GWP-IOBC | kg CO2 eq | 4.15E-01 | 2.61E-02 | 0 | 2.56E-02 | 2.47E-01 | 5.26E-04 | 0.00E+00 |

***GWP-IOBC** Global warming potential calculated according to the principle of instantaneous oxidation.*

* C1 is assumed negligible, and the value is therefore set equal to zero. To show the uncertainty for this assumption, no decimals are used.

Hazardous substances

The declaration is based upon reference to threshold values and/or test results and/or material safety data sheets provided to EPD verifiers. Documentation available upon request to EPD owner.

- X The product contains no substances given by the REACH Candidate list or the Norwegian priority list.
- ☐ The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.
- ☐ The product contains dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.
- ☐ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskriften, Annex III), see table.

### Indoor environment

Not relevant

### Carbon footprint

An individual carbon footprint has not been worked out for the product but impacts connected to climate change is reported in this EPD.

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