ENVIRONMENTAL PRODUCT DECLARATION

# SECONDARY ALUMINUM INGOT

INDUSTRY-AVERAGE SECONDARY ALUMINUM INGOT MANUFACTURED IN NORTH AMERICA

The Aluminum Association

The Aluminum Association and the aluminum industry are committed to responsible environmental stewardship. Aluminum is one of the most sustainable materials in use today:

- Strong and lightweight: Aluminum's favorable strength-to-weight ratio means it can be substituted for heavier materials, driving energy efficiency.
- Infinitely recyclable: Aluminum can be recycled over and over again without losing any of its fundamental properties.
- Efficiency improvements: Through voluntary industry efforts, the North American aluminum industry has reduced the carbon footprint of primary aluminum production by 49 percent since 1991.
- Corrosion-resistant: Durable aluminum lasts longer than many competing materials, limiting the need for replacement.
- Highly recycled: Aluminum is one of the most recycled materials on the market today. And production recycled aluminum takes just 7 percent of the energy needed to make primary aluminum.

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

# Environmental Product Declaration

The Aluminum Association

**Secondary Aluminum Ingot (100% Scrap)**
Aluminum Construction Product

According to ISO 14025 and ISO 21930:2017

| | |
|---|---|
| EPD Program and Program Operator Name, Address, Logo, and Website | UL Environment<br>333 Pfingsten Road Northbrook, IL 60611<br>WWW.UL.COM<br>www.spot.ul.com |
| General Program Instructions and Version Number | Program Operator Rules v2.7 2022 |
| Manufacturer Name and Address | The Aluminum Association<br>1400 Crystal Drive, Suite 430, Arlington, VA 22202 |
| Declaration Number | 4790545973.101.1 |
| Declared Product & Functional Unit or Declared Unit | Secondary aluminum ingot, one metric ton of secondary aluminum ingot product |
| Reference PCR and Version Number | ULE PCR Part A – Product Category Rules for Building-Related Products and Services v4<br>ULE PCR Part B – Aluminum Construction Products v1.0 |
| Description of Product Application/Use | Recycled aluminum ingot for fabrication into building products |
| Product RSL Description (if Appl.) | n/a |
| Markets of Applicability | North America |
| Date of Issue | September 27, 2022 |
| Period of Validity | 5 Years |
| EPD Type | Industry-average |
| Range of Dataset Variability | Industry-average only |
| EPD Scope | Cradle to gate with end-of-life options (C1-C4 and D) |
| Year(s) of Reported Primary Data | 2015-2019 |
| LCA Software & Version Number | GaBi 10 |
| LCI Database(s) & Version Number | GaBi 2020.1 |
| LCIA Methodology & Version Number | IPCC AR5 (GWP), TRACI 2.1 and CML v4.2 |

| | |
|---|---|
| The PCR review was conducted by: | UL Environment<br>PCR Review Panel<br>epd@ul.com |
| This declaration was independently verified in accordance with ISO 14025: 2006.<br>☐ INTERNAL ☒ EXTERNAL | Cooper McCollum, UL Environment |
| This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by: | WAP Sustainability |
| This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by: | James Mellentine, Thrive ESG |

Limitations

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

## Product Definition and Information

### Description of Company/Organization

The Aluminum Association represents aluminum production and jobs in the United States, ranging from primary production to value added products to recycling, as well as suppliers to the industry. The association is the industry's leading voice, representing companies that make 70% of the aluminum and aluminum products shipped in North America.

Based in the Washington, D.C. area, the association is the U.S. industry's leading voice — developing global standards, business intelligence, sustainability research and industry expertise for member companies, policymakers and the general public (AA, 2022).

### Product Description

**Product Identification**

This EPD covers the production of secondary aluminum ingot from aluminum scrap for further processing into aluminum semi-fabrications and products. The results represent an average across all secondary aluminum ingot manufactured in North America (United States and Canada) and includes various alloy compositions. Averages are obtained through aggregating production-weighted data from the participating companies.

**Product Specification**

| Name | Value | Unit |
|---|---|---|
| Density | 2.66-2.84 | $(kg/m^3) \times 10^3$ |
| Melting point (Typical) | 475-655 | °C |
| Electrical conductivity (Typical) at 20°C/at 68˚F | Equal Volume:16-36 | MS/m (0.58*%IACS) |
| Thermal conductivity (Typical) at 25˚c/at 77˚F | 109-234 | 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) | 69-74 | $MPa * 10^3$ |
| Chemical composition | Varying alloy by alloy, most case Al > 90 | % by mass |

### Application

Secondary aluminum ingots are used to create aluminum semi-fabricated products, such as rolled coils, casted components, or extrusions for further aluminum product manufacturing.

### Technical Requirements

Aluminum ingots do not need to comply with any particular standard. Chemical composition of most high-purity alloys follow the International Alloy Designations and Chemical Composition Limits for Wrought Aluminum and Wrought Aluminum Alloys (AA, 2018).

## Properties of Declared Product as Delivered

The output of secondary ingot production is aluminum ingot, primarily produced from aluminum scrap, suitable for rolling, extruding, or shape casting. The dimensions of the ingot vary based on the semi-fabrication requirements.

## Material Composition

In this declaration, secondary aluminum ingots are assumed to be manfactured only from aluminum scrap collected through recycling. No primary aluminum is assumed to be added. In reality, a small amount primary aluminum is often added to adjust the composition of alloys. The amount varies case by case.

The scrap is sorted and cleaned before it is used in metal production. Scrap can either be “new” or “old” depending on if it’s collected from post-industrial or post-consumer processes. Additionally, some raw material is sourced from dross and “salt cake”, which are traditionally seen as wastes from the aluminum smelting process.

The alloy composition varies based on the material in the recycling stream.

## Manufacturing

The manufacturing of secondary aluminum ingot includes the collection of aluminum scrap, the sorting/cleaning of the scrap metal, melting, and casting.

This declaration includes scrap processing starting with transportation of collected scrap, including the physical sorting and treatment of the scrap, cleaning and removal of paints or coatings, and recovery of the beneficial products.

Once the metal is collected and treated, the aluminum is liquefied in a metal furnace. Types of furnaces used for melting metal scrap include reverberatory, rotary, crucible, and electric furnaces. Reverberatory and rotary furnaces are the most common types of furnaces used to melt or remelt many different grades of aluminum scrap.

Depending on the composition of the scrap, salt or gases are injected into the molten metal to remove impurities and minimize the amount of aluminum oxide allowing for higher metal recoveries and cleaner aluminum. Once contaminants are removed, the metal may be alloyed by adding additional elements to meet the final product specification.

Finally, the molten metal is either sold or cast into ingot, bars, shot, billet, cones, or sows for subsequent use. Ingots may be formed by direct chill (DC) casting or by pouring into shallow molds. The form depends on the ultimate use of the metal.

## Packaging

Product delivery packaging includes wood, steel, paper board, and sometimes plastic wraps. Packaging is included in the scope of this EPD.

## Transportation

Supply chain material transporation is included in the scrap collection and treatment processes. In addition, a transportation distance of 100 km (62 miles) by truck has been added for the transportation of waste to end-of-life.

## Product Installation

Product installation is not under the scope of this EPD.

## Use

For the purpose of this declaration, secondary aluminum ingots are considered to be used for the manufacturing of aluminum building products, such as extrusions and sheets. No additional special conditions of use are relevant for this product under the scope of this EPD.

## Reference Service Life and Estimated Building Service Life

Service lives for secondary aluminum products vary based on their application. This EPD does not cover the product use phase and therefore makes no specific claim as to a typical reference service life.

## Recycling and Disposal

Aluminum is a highly recyclable material. During manufacturing, most process and new scrap are fed back into the production process. At the end of life, aluminum scrap is collected and sold to both secondary smelting and semi-fabrication companies. The recycling rate for aluminum scrap is assumed to be 95%. Recycling over 95% is typical for aluminum products in high volume automotive and construction market sectors (IAI, 2013).

**Table 1 Recycling and disposal**

| Name | Unit |
|---|---|
| **Deconstruction** | -- |
| **Transportation to the disposal site** | 100 km by truck |
| **Waste processing** | -- |
| **Disposal to landfill** | 5% |
| **Recycling rate of the product** | 95% |
| **Removals of biogenic carbon** | N/A |

# Life Cycle Assessment Background Information

## Declared Unit

The declared unit is the production of one metric ton of secondary aluminum ingot from scrap. The results can be converted to one kilogram by dividing by 1000.

## System Boundary

Per the PCR (UL Environment, 2022), this cradle-to-gate with options analysis provides information on the Product Stage of the aluminum product life cycle, including modules A1–A3, C1-C4 and D:

- A1 The provision of resources, additives and energy
- A2 Transport of resources and additives to the production site
- A3 Production process on site, including energy, production of additives, disposal of production residues, consideration of related emissions and recycling of production scrap (“closed loop”)

- C1 Deconstruction
- C2 Transport to the disposal site
- C3 Waste processing
- C4 Disposal at the end of the life cycle, i.e., during building deconstruction
- D Net benefits resulting from reuse, recycling and energy recovery that take place beyond the system boundary.

Table 2 below represents the system boundary and scope.

**Table 2 System boundary modules included and excluded from the study**

| | PRODUCT STAGE | | | CONSTRUCT-ION PROCESS STAGE | | USE STAGE | | | | | | | END OF LIFE STAGE | | | | BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
| | Raw material supply | Transport | Manufacturing | Transport from gate to site | Assembly/Install | Use | Maintenance | Repair | Replacement | Refurbishment | Building Operational Energy Use During Product Use | Building Operational Water Use During Product Use | Deconstruction | Transport | Waste processing | Disposal | Reuse, Recovery, Recycling Potential |
| **EPD Type** | X | X | X | MND | MND | MND | MND | MND | MND | MND | MND | MND | X | X | X | X | X |

* X = module included, MND = module not declared

It should be noted here that, C1 and C3 are to be reported as zero as they are assumed to fall below the cut-off criteria defined by ISO 21930. C2 is assumed as 100 km by truck. Materials for recycling (95%) for aluminum is reported in C4 module.

Time coverage: Aluminum Association primary data represent production within calendar year 2016. Refer to the 2022 Semi-fab LCA report for more information on temporal coverage (AA, 2022). Background data for upstream and downstream processes (i.e., raw materials, energy resources, transportation, and ancillary materials) were obtained from the GaBi 10 (CUP 2020.1) databases.

Technology coverage: Data were collected for secondary aluminum ingots produced by various AA members throughout North America.

Geographical coverage: Aluminum Association members manufacture secondary aluminum ingots in various locations in the United States and Canada. As such, the geographical coverage for this study is based on North American system boundaries for all processes and products. Whenever Canadian or U.S. background data were not readily available, European data or global data were used as proxies.

## Interpreting the Results in Module D

The values in Module D include a recognition of the benefits or impacts related to aluminum recycling which occur at the end of the product's service life. The rate of aluminum recycling and related processes will evolve over time. The results included in Module D attempt to capture future benefits, or impacts, but are based on a methodology that uses current industry-average data reflecting current processes.

A net scrap approach was taken to capture the benefits and impacts related to aluminum recycling reported in Module D. The following datasets in Table 3 were used to calculate the associated net recycling credit:

**Table 3 Background datasets used for Module D**

| **Background datasets** Invalid source specified. | **Reference year** |
|---|---|
| RNA: Secondary aluminum ingot (95% recycled content) AA | 2016 |
| RNA: Primary aluminum ingot AA | 2016 |

## Estimates and Assumptions

The LCA required only limited use of estimates and assumptions. Averages and best-estimates were used to fill in minor data gaps. Other estimates and assumptions are discussed in detail in the LCA background report.

## Cut-off Criteria

Input: All material flows that enter the system and are over 1% of the product mass or contribute more than 1% to the primary energy consumption are included.

Output: All material flows that exit the system and whose environmental impact makes up more than 1% of the total impact in an impact category considered are included.

## Data Sources

In order to model the life cycle for the production of secondary aluminum ingots, the GaBi 10 software system developed by Sphera was used. All relevant background data necessary for the production of secondary aluminum ingots were taken from the GaBi 2020 databases or were made available by the Aluminum Association through industry survey results. Companies participating in the project, either with AA or AIA, are provided in the Participating Companies section.

Primary aluminum used in North America is sourced domestically and from other geographic regions, for which carbon intensity information is shared in the below Table 4:

**Table 4 Data sources, origin and carbon intensity for primary aluminum**

| **Dataset** | **Geographic origin** | **Electricity sources** (IAI, 2017) | **Carbon intensity** (kg $CO_2$ eq/kWh) |
|---|---|---|---|
| RNA: Primary aluminum ingot | Domestic (North America) | Hydro (80%), lignite (17%), natural gas (3%), nuclear and fuel oil: <1% | 0.214 |
| RLA: Aluminum ingot mix IAI 2015 | Argentina | Hydro (64%), natural gas (35%), coal <1% | 0.393 |
| RME: Aluminum ingot mix IAI 2015 | Bahrain | Natural gas (100%) | 0.45 |
| RLA: Aluminum ingot mix IAI 2015 | Brazil | Hydro (64%), natural gas (35%), coal <1% | 0.393 |
| RU: Aluminum ingot mix IAI 2015 | Russia | Hydro (98%), coal (2%) | 0.0421 |
| RME: Aluminum ingot mix IAI 2015 | United Arab Emirates | Natural gas (100%) | 0.45 |
| RLA: Aluminum ingot mix IAI 2015 | Venezuela | Hydro (64%), natural gas (35%), coal <1% | 0.393 |
| GLO: Aluminum ingot mix IAI 2015 | Rest of the World | Hydro (25%), coal (64%), natural gas | 0.778 |

| | | | |
|---|---|---|---|
| | | (10%), nuclear (1%), oil <1% | |

## Data Quality

The data is considered of high quality. Inventory data quality is judged by its precision (measured, calculated or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methodology applied on a study serving as a data source) and representativeness (geographical, temporal, and technological). To cover these requirements and to ensure reliable results, first-hand industry data in combination with consistent background life cycle inventories from the GaBi 2020 database were used (Sphera, 2021).

The LCI data sets from the GaBi database are widely distributed and used with the GaBi 10 Software. The datasets have been used in LCA models worldwide in industrial and scientific applications in internal as well as in many critically reviewed and published studies. In the process of providing these datasets, they are cross-checked with other databases and values from industry and science.

## Period under Review

Primary data for the production of secondary aluminum ingots is collected by the Aluminum Association. Primary data collected from the participating companies and from their operational activities is representative for the year of 2016. Additional data necessary to model raw material production, energy generation, etc. were adopted from the GaBi 2020 database with typical reference years between 2016 and 2021.

## Allocation

Internal recycling of by-products (e.g., salt cake, dross) is included within the system boundary. Note that co-product allocation may also be used in background data from the GaBi database (e.g., caustic acid).

The “net scrap” substitution approach is used to address recycled content, post-industrial scrap, and post-consumer scrap. Under this approach, the end-of-life scrap collected for recycling is first reduced by the scrap inputs into production. Only the remaining *net scrap* is then modeled as being sent to material recycling in order to avoid double-counting the benefits of using recycled content. If more scrap is recovered at product end-of-life than is required in the manufacturing stage, the product system receives a credit equal to the burden of primary material production minus the burden of recycling scrap into secondary material based on the mass of secondary material produced. If less scrap is recovered at product end-of-life than is required in the manufacturing stage, this net credit becomes a net burden.

## Comparability (Optional)

A comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to ISO 21930 and the building context, respectively the product-specific characteristics of performance are taken into account.

# Life Cycle Assessment Results

The results from the Aluminum Association secondary ingots are given below. While interpreting the Module D results one should consider that, the values in Module D include a recognition of the benefits or impacts related to aluminum recycling which occur at the end of the product’s service life. The rate of aluminum recycling and related processes will evolve over time. The results included in Module D attempt to capture future benefits, or impacts, but are based on a methodology that uses current industry-average data reflecting current processes.

GWP excludes biogenic carbon as there are no relevant biogenic carbon removals or emissions in the life cycle. There is no calcination, carbonation and combustion of waste from non-renewable sources.

## Life Cycle Impact Assessment Results

**Table 5. North American Impact Assessment Results**

| TRACI v2.1 | UNIT | A1-A3 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|
| IPCC AR5 GWP | [kg $CO_2$-Eq.] | 5.26E+02 | - | 9.90E+00 | - | 2.17E+00 | 4.29E+02 |
| ODP | [kg CFC11-Eq.] | 3.78E-13 | - | 1.05E-15 | - | 7.02E-15 | -3.24E-14 |
| AP | [kg $SO_2$-Eq.] | 8.65E-01 | - | 2.85E-02 | - | 9.49E-03 | 2.03E+00 |
| EP | [kg $(PO_4)^{3-}$-Eq.] | 3.99E-02 | - | 3.36E-03 | - | 5.35E-04 | 4.51E-02 |
| SFP | [kg $O_3$-Eq.] | 1.56E+01 | - | 6.40E-01 | - | 1.67E-01 | 1.67E+01 |
| $ADP_{fossil}$ | [MJ] | 1.14E+03 | - | 1.86E+01 | - | 4.25E+00 | 2.88E+02 |

**Table 6. EU Impact Assessment Results**

| CML v4.2 | UNIT | A1-A3 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|
| GWP | [kg $CO_2$-Eq.] | 5.23E+02 | - | 9.88E+00 | - | 2.16E+00 | 4.28E+02 |
| ODP | [kg CFC11-Eq.] | 3.99E-13 | - | 1.05E-15 | - | 7.02E-15 | 1.46E-13 |
| AP | [kg $SO_2$-Eq.] | 7.86E-01 | - | 2.12E-02 | - | 8.75E-03 | 2.19E+00 |
| EP | [kg $(PO_4)^{3-}$-Eq.] | 9.47E-02 | - | 6.49E-03 | - | 1.17E-03 | 1.31E-01 |
| POCP | [kg Ethane-Eq.] | 7.08E-02 | - | -7.13E-03 | - | 7.64E-05 | 1.08E-01 |
| $ADP_{fossil}$ | [MJ] | 8.32E+03 | - | 1.39E+02 | - | 3.27E+01 | 3.90E+03 |
| $ADP_{elements}$ | [kg Sb-Eq.] | 7.38E-07 | - | 1.60E-09 | - | 1.80E-09 | 1.75E-07 |

## Life Cycle Inventory Results

**Table 7. Resource Use**

| PARAMETER | UNIT | A1-A3 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|
| $RPR_E$ | [MJ] | 5.46E+02 | - | 5.82E+00 | - | 2.71E+00 | 2.82E+03 |
| $RPR_M$ | [MJ] | - | - | - | - | - | - |
| $RPR_T$ | [MJ] | 5.46E+02 | - | 5.82E+00 | - | 2.71E+00 | 2.82E+03 |
| $NRPR_E$ | [MJ] | 8.62E+03 | - | 1.40E+02 | - | 3.35E+01 | 3.96E+03 |
| $NRPR_M$ | [MJ] | 1.49E+00 | - | - | - | - | 8.01E+00 |
| $NRPR_T$ | [MJ] | 8.62E+03 | - | 1.40E+02 | - | 3.35E+01 | 3.98E+03 |
| SM | [kg] | 1.00E+03 | - | - | - | - | -5.40E+01 |
| RSF | [MJ] | - | - | - | - | - | - |
| NRSF | [MJ] | - | - | - | - | - | - |
| RE | [MJ] | - | - | - | - | - | - |
| FW | [$m^3$] | 1.69E+00 | - | 2.62E-02 | - | 4.75E-03 | 9.35E+00 |

**Table 8. Output Flows and Waste Categories**

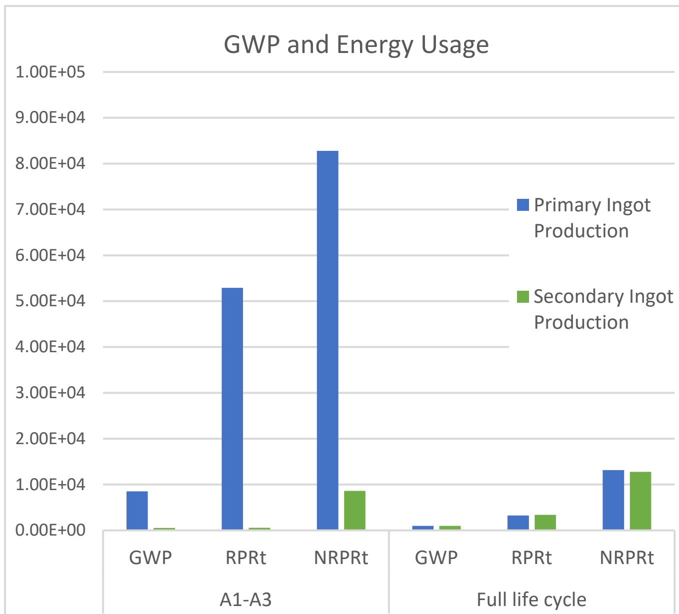
| PARAMETER | UNIT | A1-A3 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|
| HWD | [kg] | 3.76E-06 | - | 2.40E-06 | - | 2.24E-07 | 2.41E-06 |
| NHWD | [kg] | 2.18E+01 | - | - | - | 5.00E+01 | 1.28E+02 |
| HLRW | [kg] | 1.39E-04 | - | 3.05E-07 | - | 3.30E-07 | 3.40E-05 |
| ILLRW | [kg] | 3.81E-03 | - | 8.16E-06 | - | 8.70E-06 | 8.60E-04 |
| CRU | [kg] | - | - | - | - | - | - |
| MFR | [kg] | 3.54E-02 | - | - | 9.50E+02 | - | 2.94E-01 |
| MER | [kg] | 1.66E-01 | - | - | - | - | 7.43E-01 |
| EE | [MJ] | - | - | - | - | - | - |

## LCA Interpretation

From a cradle-to-gate perspective and compared to the production of primary aluminum, secondary aluminum ingot requires less resources and contributes less impacts. Secondary ingot production requires only 6% of the energy used to produce primary ingot, and results in about 6% of the GWP. This 94% savings explains the drive for increased aluminum recycling.

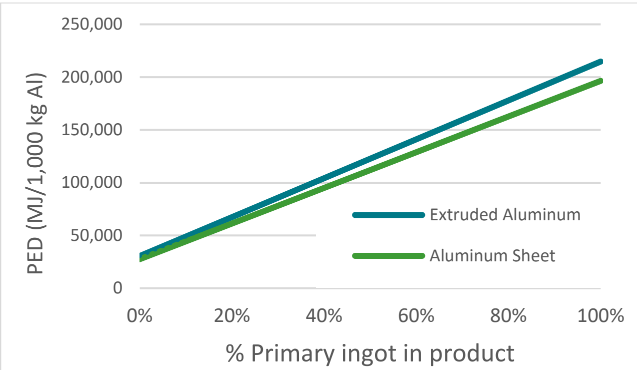
This trend changes however when adding in the end of life and recycling credit modules (C and D). Primary and secondary ingots have almost the same results over the full life cycle.

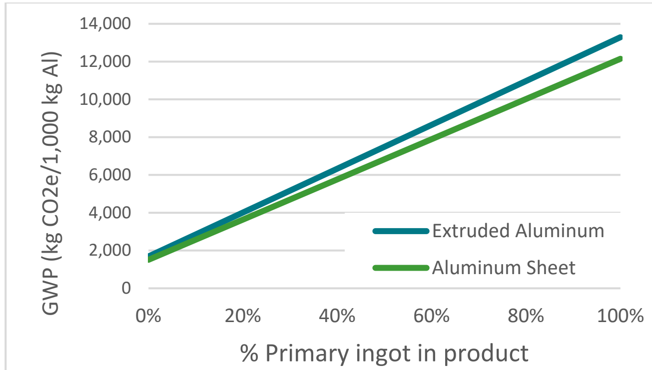
This might reside in the fact that the recycling credit is based on a recycling process at end of life that has some associated losses (5%). For primary ingot recycling, this recycling process step occurs once, while for secondary ingot, the process happens twice within the system boundary.




### Sensitivity Analysis

A sensitivity analysis has been conducted to examine the impact of increasing primary aluminum content in semi-finished products. Given the significant influence of primary aluminum on the cradle-to-gate footprint, one way to address it is to reduce the use of primary aluminum and increase the use of recycled metal. As shown below, a one percent increase in primary aluminum content in the products will increase the cradle-to-gate primary energy demand and global warming potential by as much as 1856 MJ and 117 kg CO2e, respectively, for 1,000 kg semi-finished products. This is equal to say that a one percentage point increase in recycled aluminum content will reduce the energy demand and carbon footprint by the same amount.



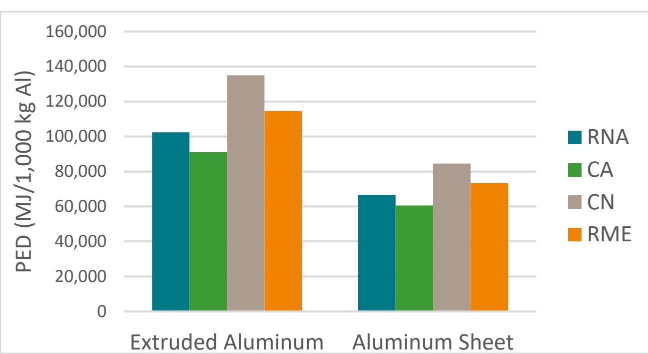



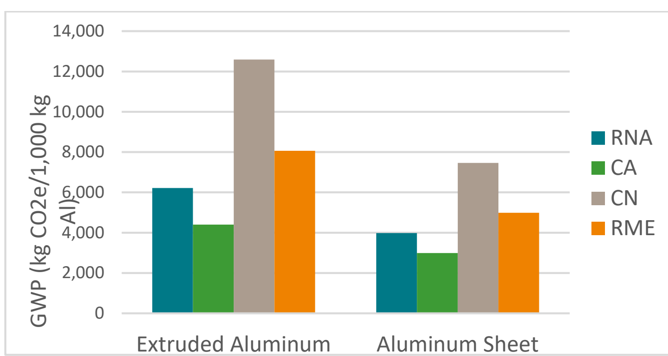

## Scenario Analysis

To see the effect of primary aluminum sourcing, a scenario analysis was conducted to alternate the sourcing from different regions or countries other than the baseline case of the North American consumption mix. The metal compositions – shares of primary and recycled metal in the products, are kept unchanged for the scenario analysis. Both figures below show the effects of primary aluminum sourcing on cradle-to-gate primary energy demand and global warming potential, respectively. The regions and countries included in the scenario analysis are:

- RNA represents the weighted average of primary aluminum consumption mix in North America, which is the baseline case;
- CA represents Canada where primary aluminum is exclusively smelted with hydropower electricity;
- CN represents China where primary aluminum is mainly smelted with coal-fired electricity;
- RME represents the Middle East where primary aluminum is mainly smelted with natural gas fired electricity.

Clearly, the scale of difference is dependent both on impact category (e.g., PED or GWP) and on how much primary aluminum content is in the products. The more primary aluminum is in the product, the more striking the difference between hydropower smelted aluminum and coal-power smelted aluminum. The difference is more prominent for GWP than it is for PED. The cradle-to-gate carbon footprint of aluminum sheet made of Chinese primary aluminum would be 3.2 times higher than it is made of Canadian primary aluminum under the same share of primary and recycled content as the baseline case.




For additional sensitivity and scenario analysis information for the above products, please refer to the report (Aluminum Association, 2022).

## Additional Environmental Information

### Environment and Health During Manufacturing

**Air**: Hazardous air emission releases comply with regulatory thresholds.

**Water/soil**: Pollutants in wastewater are comply with regulatory thresholds

**Noise**: Due to adequate acoustical absorption devices, measurements of sound levels have shown that all values inside and outside the production plant and comply with regulatory thresholds.

### Environment and Health During Use

The environmental and health effects during use are dependent on the ultimate use of the secondary aluminum ingot and are outside the scope of this EPD. The following general statements are relevant for all aluminum products:

- Aluminum products are often made from both primary and recycled ingots
- There is no relevant chemical composition difference between primary and secondary ingots if both are governed by the same alloy designation and chemical composition limit standards
- The service life of the final product depends on its application, but is typically long due to aluminum's excellent durability and corrosion resistance
- For that same reason, maintenance needs during use are usually low.

### Extraordinary Effects

**Fire**: Aluminum products comply with ASTM E 136-11.

**Water**: There is no evidence to suggest water runoff or exposure under normal and intended operation will violate general water quality standards.

**Mechanical destruction**: Not relevant for aluminum.

## References

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## Contact Information

### Study Commissioner

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### LCA Practitioner

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## Participating Companies

| No. | Company | Note |
|---|---|---|
| 1 | Alcoa Corporation | Primary aluminum |
| 2 | Arconic Corporation | Recycling, sheet, extrusion |
| 3 | Century Aluminum | Primary aluminum |
| 4 | Commonwealth Rolled Products | Formally Aleris International, recycling, sheet |
| 5 | Constellium | Recycling, sheet, extrusion |
| 6 | Howmet | Formally part of Arconic, recycling, sheet, extrusion |
| 7 | Hydro Extrusions North America | Recycling, extrusion |
| 8 | Hydro Metals North America | Recycling, extrusion billet |
| 9 | Jupiter Aluminum | Recycling, sheet |
| 10 | JW Aluminum | Recycling, sheet, foil |
| 11 | Kaiser Aluminum | Recycling, sheet, extrusion |
| 12 | Keymark | Recycling, extrusion |
| 13 | Novelis Inc. | Recycling, sheet, foil |
| 14 | Real Alloys | Recycling, RSI |
| 15 | Rio Tinto | Primary aluminum |
| 16 | Reynolds | Foil |
| 17 | Scepter Inc. | Recycling, RSI |
| 18 | Skana | Recycling, sheet |
| 19 | Smelter Service Corporation | Recycling, RSI |
| 20 | United Aluminum | Recycling, sheet |