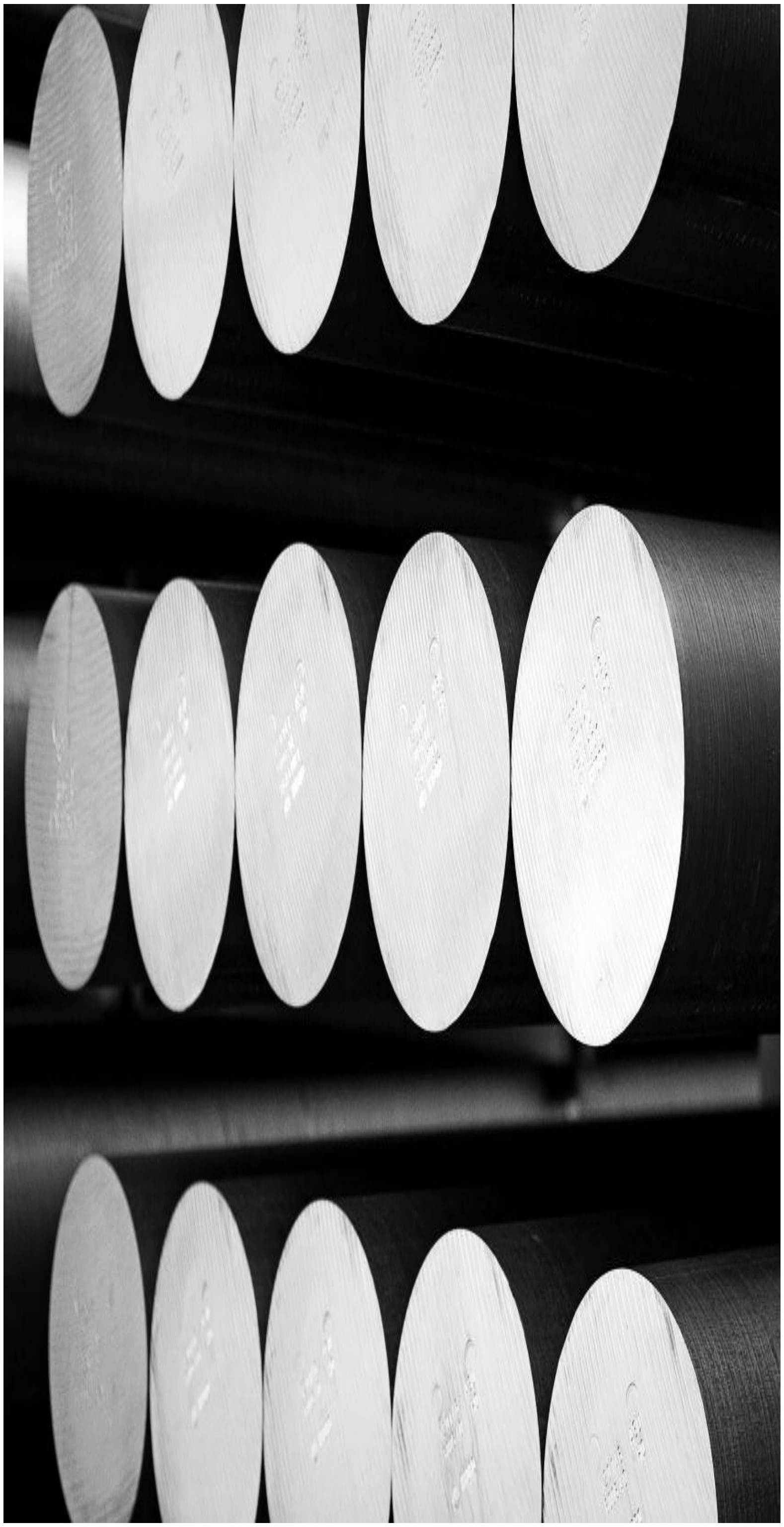
Environmental Product Declaration

Aluminum Billet

AVERAGE CAST BILLET – SPANISH FORK, UTAH



Hydro

Hydro is a leading aluminum and energy company that builds businesses and partnerships for a more sustainable future. We develop industries that matter to people and society.

Since 1905, Hydro has turned natural resources into valuable products for people and businesses, creating a safe and secure workplace for our 32,000 employees in more than 140 locations and 40 countries.

Today, we own and operate various businesses and have investments with a base in sustainable industries. Hydro is present in a broad range of market segments for aluminum and metal recycling, and energy and renewables. We offer a unique wealth of knowledge and competence.

Hydro is committed to leading the way towards a more sustainable future, creating more viable societies by developing natural resources into products and solutions in innovative and efficient ways.

CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION
UL.COM/EPD

ALUMINUM BILLET
AVERAGE CAST BILLET - SPANISH FORK, UTAH

According to ISO 14025, ISO 21930:2017

EPD Program and Program Operator Name, Address, Logo, and Website	UL Environment 333 Pfingsten Rd; Northbrook, IL 60062-2096 USA www.ul.com www.spot.ul.com
General Program Instructions and Version Number	Program Operator Rules v 2.7 2022
Manufacturer Name and Address	Hydro Extrusion North America 1550 North Hydro Way, Spanish Fork, UT 84660 USA
Declaration Number	4790427057.103.1
Declared Product & Functional Unit or Declared Unit	Aluminum billet; – declared: 1 kg of aluminum billet plus primary packaging
Reference PCR and Version Number	Product Category Rules (PCR) Guidance for Building Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements, UL 10010 v.4 March 2022 Product Category Rules (PCR) Guidance for Building Related Products and Services Part B: Aluminum Construction Product EPD Requirements, UL 10010 – 38 v.1 February 2022
Description of Product Application/Use	Aluminum billet used in input to extrusion for production of aluminum profiles for construction and/or other market sectors
Product RSL Description (if Appl.)	Not applicable
Markets of Applicability	North America
Date of Issue	May 1, 2024
Period of Validity	5 Years
EPD Type	Product-specific
EPD Scope	Cradle to gate with options modules C1-C4, module D included
Year(s) of Reported Primary Data	2022
LCA Software & Version Number	LCA for Experts 10.8.0.14
LCI Database(s) & Version Number	MLC DB 2023.2
LCIA Methodology & Version Number	IPCC AR5 (GWP100), TRACI 2.1 and CML-IA v.4.8 August 2016 (ADPf)

The PCR review was conducted by:	UL Solutions PCR Review Panel epd@ul.com
This declaration was independently verified in accordance with ISO 14025: 2006. ☐ INTERNAL ☒ EXTERNAL	Cooper McCollum, UL Solutions
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	Ecoinnovazione
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas P. Gloria, Industrial Ecology Consultants

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.

1. Product Definition and Information

Description of Company/Organization

Through our unique combination of local expertise, global network, and unmatched R&D capabilities, Hydro can offer everything from standard profiles to advanced development and manufacturing for most industries. Hydro is committed to leading the way in shaping a sustainable future and in doing so, creating more viable societies by developing natural resources into products and solutions in innovative and efficient ways.

Product Description

Product Identification

This EPD covers the production of aluminum billet manufactured in the Hydro recycling facility located in Spanish Fork, Utah, USA. The results are representative of the average cast billet. Table 1 reports the product description, whereas Figure 1 describes the production process.

Table 1. Product description

FIELD	DESCRIPTION
PRODUCT NAME	Aluminum billet
PRODUCT DESCRIPTION	Aluminum billet produced employing primary ingots, aluminum scrap and alloying elements.
CLASSIFICATION	Ingot/billet
ALLOY GROUP	6000 series

Flow Diagram

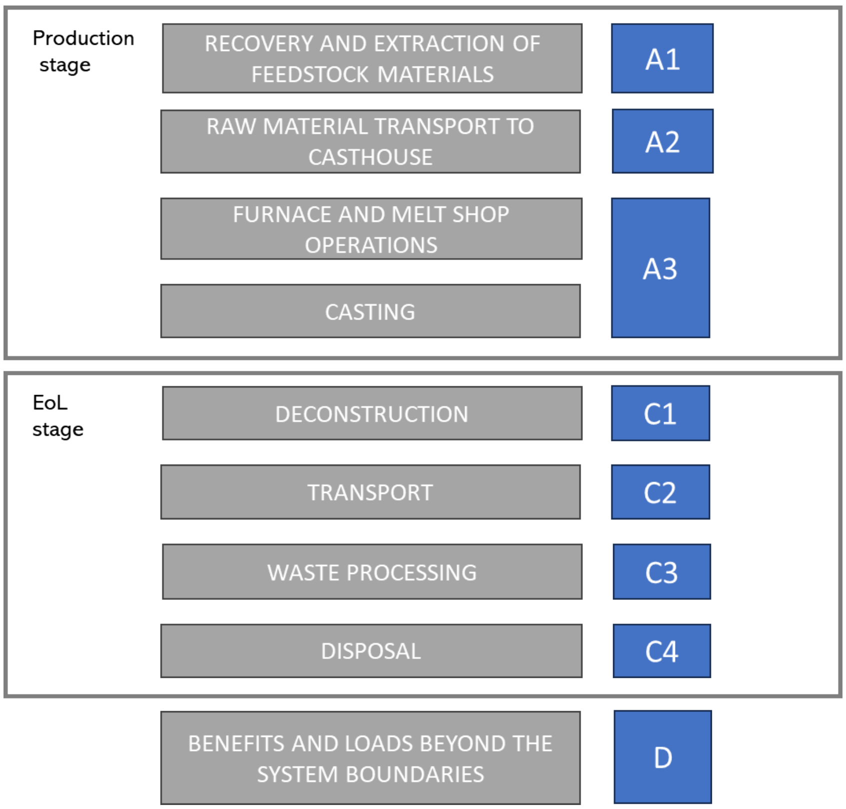


Figure 1.Scheme of the billet manufacturing process occurring at Spanish Fork

Application

The studied aluminum billets are used in the production chains of other products. More in detail, are used in input to the extrusion processes for the production of aluminum profiles which are used in several market sectors (building and construction, transportation, electrical and energy, etc.)

Declaration of Methodological Framework

This EPD is declared under “cradle to gate with options” system boundaries. As such, it includes A1-A3, C1-C4 and D modules.

Material Composition

The type of aluminum alloys and their chemical aluminum composition is reported in Table 2, whereas the main product materials that make up the product are described in Table 3. No substances required to be reported as hazardous are associated with the production of this product.

Table 2. Types of Aluminum, as per teal sheet (AA, 2018)

Designation and Chemical Composition Limits																
	Si	***Fe***	***Cu***	***Mn***	***Mg***	***Cr***	***Ni***	***Zn***	***Ti***	***B***	***Bi***	***Pb***	***Sn***	***V***	***Zr***	***Others Each***	***Aluminum***
Min	0.2	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0		remainder
Max	4	1	1.2	1.4	3	0.4	0.2	1.5	0.25	0.06	1.5	2	2	0.3	0.2	0.05	remainder

Table 3. Primary and recycled material composition

Material Input		Value
Primary material		9.67% mass
Recycled material	Pre-consumer	44.10% mass
	Post-consumer	46.23% mass

Technical parameters

Table 4. Technical data

Technical Parameter	Value	Unit
Gross density	2700	Kg/m^3
Melting point	582-652	°C
Electrical conductivity at 20°C	33.7	Ms/m
Coefficient of thermal expansion	NA	$10^{-6}K^{-1}$
Modulus of elasticity	68900	N/mm^2
Shear modulus	NA	N/mm^2
Specific heat capacity	900	J/(kg*K)
Hardness	95	HB
Yield Strength RP 0.2 Min	240	N/mm^2
Tensile strength RM min	260	N/mm^2
Tensile Stress at Break	12	%

Manufacturing

The production stage consists of the aluminum melting (aluminum scrap and primary ingots) and the following casting process. The melting occurs in the melting furnace. Here, impurities (dross) are removed, and the alloys elements are added based on the exact chemical composition resulting from a chemistry check. Alloys elements include boron-titanium, silicon, copper, manganese, and magnesium alloy. Once the right temperature is reached, the aluminum is poured into the casting (holding) furnace. Further, alloys are added in the holding furnace to adjust the chemistry, if needed. The casting process includes a degassing, by means of argon, with the aim of removing eventual further impurities. The cooling process is performed in the context of the casting process. The last processing steps include homogenization, cutting, marking, and final packaging.

Packaging

It was not possible in the plant to account for packaging materials used for billets and packaging materials used for profiles produced in the same site. To avoid double counting of packaging impacts, total amount of packaging materials purchased entering the site are allocated to the total amount of products in output from the whole set of production line. Wood, plastic, cardboard and paper are used in the site. Table 5 reports the amount allocated to 1 kg of aluminum product in output

Table 5. Packaging type and weight used for the billets per declared unit

TYPE OF PACKAGING	AMOUNT PER DECLARED UNIT (KG/KG)
Wood bars	3.33E-03
Plastic strap	1.67E-04
Cardboard	7.69E-05
Paper	1.35E-05

Recycling and disposal

Aluminum is 100% recyclable and can be recycled repeatedly. Basically, in building and construction, aluminum has a recycling rate of 95% (UNEP, 2011), meaning that 95% of the collected aluminum is recycled, the remaining 5% is lost in the pretreatment process. Conservatively, it is assumed that only 94% of the aluminum reaching the end of life is collected. Aluminum not collected and aluminum lost in the pretreatment process is sent to landfill.

2. Life Cycle Assessment Background Information

Functional or Declared Unit

The declared unit of this EPD is 1 kg of aluminum billet.

System Boundary

This EPD is cradle to gate with optional modules (as presented in Table 6). Modules A5 and B1 to B7 are excluded as they are strongly dependent on the specific application within the reference market.

The following stages are included in the study:

- **Raw Materials supply (A1).** Production of raw materials used in the products. More in detail, A1 includes:
  - Production of primary ingots
  - Production of aluminum included in process scrap
  - Shredding and sorting of post-consumer scrap
  - Production of alloys

  The production of energy carriers used in the production process is part of A1 as well.
- **Transport of raw materials to the factory (A2)**
- **Manufacturing of the Hydro aluminum billet (A3)**. It includes the following production phases:
  - Melting, alloying and casting

- Cutting and homogenization
- Cooling and binding (packaging) for final storage

Moreover, in module A3, the production of primary packaging, of the ancillary materials and the treatment of waste generated from the manufacturing processes are accounted for. Since module A5 is excluded, the CO2 stocked in the packaging has been balanced with an equal emission of CO2.

- **Deconstruction (C1) –** demolition processes
- **Transport (C2) –** Transport to waste processing and to disposal
- **Waste processing (C3) –** shredding and sorting of aluminum collected at deconstruction step
- **Disposal (C4) –** Landfill of fractions lost in C1 and C3
- **Reuse, recovery and recycling potential (D) –** transport to remelting site, remelting and avoided primary production

Table 6. Description of system boundaries

DESCRIPTION OF THE SYSTEM BOUNDARIES																
Production			Construction		Use							End of life				Benefits and loads beyond system boundaries
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material supply	Transport	Manufacturing	Transport to site	Assembly / installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	De- construction / Demolition	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling potential
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

X= Module included in the EPD; MND= Module not declared

Estimates and Assumptions

All the raw materials and energy input have been modeled using processes and flows that closely follow actual production data on raw materials and processes. All reported raw materials and energy flows have been accounted for. No known raw materials and energy flows are deliberately excluded from the present EPD.

Cut-off Criteria

Few minor chemicals are excluded as well as the packaging of some specific chemicals (e.g. of cooling tower chemicals) The construction of the manufacturing site is excluded as well. In case where no matching life cycle inventory are available to represent a flow, proxy data have been applied based on conservative assumptions.

Data Sources

The LCA model was created with the support of LCA for Expert v. 10.8.0.14 software and MLC Database version 2023.2.

Primary aluminum production datasets from Aluminum Association (AA) and from International Aluminum Institute (IAI) have been used to represent the primary ingots purchased in Canada (IAI). The resulting carbon intensity associated to the primary ingot mix entering the plant is reported in Table 7.

The aluminum datasets used in the study are the most recent released by industry association (IAI).

Table 7. Data source, origin and carbon intensity of primary aluminum

DATASETS USED IN THE CALCULATION	CARBON INTENSITY OF ELECTRICITY (KG CO_2/KWH)	WEIGHTED AVERAGE POWER MIX (%)	GEOGRAPHIC ORIGIN
CA: Primary Aluminum Ingot (IAI)	1.53E-02	100% - Hydro	Canada

Data Quality

Specific data were collected at the Hydro's manufacturing site for the reference year for the modelling of the manufacturing phase.

The majority of the generic data used in the study comes from Sphera database, which has updated all its processes to 2022. Therefore, the study is in line with the ISO 21930 requirements on the time representativeness of the selected generic data (not older than 10 years).

Period under Review

Primary data were collected for Hydro's manufacturing process over 12 months during 2022 calendar year. Background data for upstream and downstream processes were obtained from MLC Database version 2023.2.

Allocation

The allocation is made in accordance with the provisions of ISO 21930. Energy and resources (water and ancillary) in input and waste and emissions in output from the manufacturing processes are allocated to the final product based on the mass.

3. Life Cycle Assessment Scenarios

Table 8. End of life scenario (C1-C4)

COLLECTION, RECOVERY AND DISPOSAL		VALUE	UNIT
Assumptions for scenario development (description of deconstruction, collection, recovery, disposal method and transportation) – see Recycling and Disposal in section 1			
Collection process (specified by type)	Collected separately	0.96	kg
	Collected with mixed construction waste	0.04	kg
Recovery (specified by type)	Reuse	-	kg
	Recycling	0.912	kg
	Landfill	0.088	kg
	Incineration	-	kg
	Incineration with energy recovery	-	kg
	Energy conversion efficiency rate	-	
Disposal (specified by type)	Product or material for final deposition	0.088	kg
Removals of biogenic carbon (excluding packaging)		-	kg CO2

The transport between demolition site and landfill is assumed to be 100 km. Similarly, the transport between preprocessing site and landfill and between demolition site and preprocessing site is assumed to be 100 km.

Benefits and loads beyond the system boundaries (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. Such recognition includes the transport, a distance of 100 km is assumed between the processing site and the remelting site. The rate of aluminum recycling and related processes is expected 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.

Values in Module D are calculated based on a net scrap approach, based on recycled content resulting from Table 3 and recycling rate resulting from Table 8, and re-called in Table 9. Datasets in Table 10 were used for the calculation.

Table 9. Recycling rate and recycled content of the product

NAME	VALUE	UNIT
Recycling rate of the product	91.20%	%
Recycled content of the product	90.33%	%

Table 10. Background datasets used for Module D

Background Datasets	Reference Year
RNA: Recycled aluminum ingot (100% recycled content)	2016
RNA: Primary aluminum ingot	2016

The net scrap approach is based on the perspective that the material that is recycled into secondary material at the end of life will replace an equivalent amount of virgin material. Hence a credit is given to account for this material substitution. However, this also means that a burden should be assigned to scrap used as input to the recycling process. This approach rewards the end of life recycling but does not reward the recycled content.

4. Life Cycle Assessment Results

Comparability:

Environmental declarations from different programs based upon differing PCRs may not be comparable.

Comparison of the environmental performance of construction works and construction products using EPD information shall be based on the product's use and impacts at the construction works level. In general, EPDs may not be used for comparability purposes when not considered in a construction works context. Given this PCR ensures products meet the same functional requirements, comparability is permissible provided the information given for such comparison is transparent and the limitations of comparability explained.

When comparing EPDs created using this PCR, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to different results for upstream or downstream of the life cycle stages declared.

Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted.

Any comparison of EPDs shall be subject to the requirements of ISO 21930. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparison can be inaccurate, and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

Life Cycle Impact Assessment Results

Table 11. North American Impact Assessment Results

IMPACT CATEGORY*	UNIT	A1	A2	A3	C1	C2	C3	C4	D
Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (ADPfossil)	[MJ, LHV]	5.77E+00	1.88E+00	4.14E+00	0.00E+00	1.30E-01	3.08E-01	1.71E-02	-6.30E+00
Global Warming Potential (GWP 100), IPCC 2013	[kg CO2 eq]	6.18E-01	1.32E-01	2.84E-01	0.00E+00	9.04E-03	2.48E-02	1.26E-03	-6.95E-01
Acidification Potential (AP)	[kg SO2 eq]	3.21E-03	7.58E-04	2.55E-04	0.00E+00	5.09E-05	3.71E-05	8.06E-06	-3.28E-03
Eutrophication Potential (EP)	[kg N eq]	5.40E-05	6.34E-05	3.52E-05	0.00E+00	4.31E-06	2.81E-06	3.56E-07	-6.99E-05
Ozone Depletion Potential (ODP)	[kg CFC 11 eq]	6.17E-15	3.01E-16	4.81E-15	0.00E+00	2.06E-17	2.54E-15	7.08E-17	-2.22E-16
Smog Formation Potential (SFP)	[kg O3 eq]	2.32E-02	1.77E-02	7.20E-03	0.00E+00	1.18E-03	5.23E-04	1.53E-04	-2.63E-02

*GWP 100 according to IPCC AR5; ADP fossil according to CML 2001 v4.8 (August 2016); all other indicators according to TRACI 2.1.

Life Cycle Inventory Results

Table 12. Resource Use Indicators

PARAMETER	UNIT	A1	A2	A3	C1	C2	C3	C4	D
RPRE: Renewable primary resources used as energy carrier (fuel)	[MJ]	6.11E+00	7.54E-02	4.54E-01	0.00E+00	5.08E-03	1.00E-01	2.87E-03	-4.61E+00
RPRM: Renewable primary resources with energy content used as material	[MJ]	0.00E+00	0.00E+00	1.36E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRPRE: Non-renewable primary resources used as an energy carrier (fuel)	[MJ]	5.88E+00	1.89E+00	4.18E+00	0.00E+00	1.30E-01	4.24E-01	1.76E-02	-6.42E+00
NRPRM: Non-renewable primary resources with energy content used as material	[MJ]	0.00E+00	0.00E+00	7.23E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM: Secondary materials	[kg]	9.03E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF: Renewable secondary fuels	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF: Non-renewable secondary fuels	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE: Recovered energy	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW: Use of net fresh water resources	[m3]	1.90E-02	2.50E-04	1.36E-03	0.00E+00	1.76E-05	1.69E-04	4.45E-06	-1.53E-02
RPRT Total use of renewable primary resources with energy content	[MJ]	6.11E+00	7.54E-02	4.55E-01	0.00E+00	5.08E-03	1.00E-01	2.87E-03	-4.61E+00
NRPRT Total non-renewable primary resources with energy content	[MJ]	5.88E+00	1.89E+00	4.19E+00	0.00E+00	1.30E-01	4.24E-01	1.76E-02	-6.42E+00

Table 13. Output Flows and Waste Flows

Parameter	Unit	A1	A2	A3	C1	C2	C3	C4	D
HWD: Hazardous waste disposed	[kg]	0.00E+00	0.00E+00	2.12E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD: Non-hazardous waste disposed	[kg]	0.00E+00	0.00E+00	2.92E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
HLRW: High-level radioactive waste, conditioned, to final repository	[kg]	4.91E-08	5.42E-09	2.19E-08	0.00E+00	3.80E-10	4.91E-08	2.05E-10	-5.59E-08
ILLRW: Intermediate- and low-level radioactive waste, conditioned, to final repository	[kg]	4.08E-05	4.60E-06	1.87E-05	0.00E+00	3.20E-07	4.10E-05	2.01E-07	-4.48E-05
CRU: Components for re-use	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR: Materials for recycling	[kg]	0.00E+00	0.00E+00	5.12E-02	0.00E+00	0.00E+00	9.12E-01	0.00E+00	8.81E-02
MER: Materials for energy recovery	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE: Recovered energy exported from the product system	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 14. Carbon Emissions and Removals

Parameter	Unit	A1	A2	A3	C1	C2	C3	C4	D
BCRP: Biogenic Carbon Removal from Product	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP: Biogenic Carbon Emission from Product	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK: Biogenic Carbon Removal from Packaging	[kg CO2]	0.00E+00	0.00E+00	5.16E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEK: Biogenic Carbon Emission from Packaging	[kg CO2]	0.00E+00	0.00E+00	5.16E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEW: Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE: Calcination Carbon Emissions	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR: Carbonation Carbon Removals	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR: Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Alternative life cycle assessment results

The present section reports the LCIA indicators calculated considering the process scrap (industrial scrap) as a co-product. In this approach, the process scrap entering the billet production takes the same burden of the original billet used in the production process who generated the scrap. For pre-consumer scrap retrieved in the US market, whose original billet source is unknown, a primary ingot production dataset for North America (AA) is used. Pre-consumer scrap retrieved from Hydro's extrusion lines external to the Spanish Fork, is modeled as the average aluminum consumed by Hydro Extrusion North America, whose model includes post-consumer at 17.40% and primary metal for the remaining %. Used datasets are listed in Table 15 and LCIA results in Table 16.

Table 15. Data source and origin of primary aluminum considered for the model of pre-consumer scrap retrieved at Hydro's extrusion lines external to Spanish Fork. It applies for the alternative LCIA results (co-product approach)

DATASET USED IN THE CALCULATION	GEOGRAPHIC ORIGIN
Primary aluminum ingot (AA)	North America
Aluminum ingot mix (IAI)	Canada
Aluminum ingot mix (IAI)	Global
Aluminum ingot mix (IAI)	East Middle East

Table 16. Alternative Life Cycle Impact Assessment Results (co-product approach for the modeling of pre-consumer scrap)

IMPACT CATEGORY*	UNIT	A1	A2	A3	C1	C2	C3	C4	D
Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (ADPfossil)	[MJ, LHV]	3.98E+01	1.88E+00	4.05E+00	0.00E+00	1.30E-01	3.08E-01	1.71E-02	-3.05E+01
Global Warming Potential (GWP 100), IPCC 2013	[kg CO2 eq]	4.11E+00	1.31E-01	2.78E-01	0.00E+00	9.04E-03	2.48E-02	1.26E-03	-3.35E+00
Acidification Potential (AP)	[kg SO2 eq]	1.94E-02	7.58E-04	2.50E-04	0.00E+00	5.09E-05	3.71E-05	8.06E-06	-1.58E-02
Eutrophication Potential (EP)	[kg N eq]	4.21E-04	6.33E-05	3.45E-05	0.00E+00	4.31E-06	2.81E-06	3.56E-07	-3.48E-04
Ozone Depletion Potential (ODP)	[kg CFC 11 eq]	2.45E-13	3.01E-16	4.71E-15	0.00E+00	2.06E-17	2.54E-15	7.08E-17	-1.13E-15
Smog Formation Potential (SFP)	[kg O3 eq]	1.66E-01	1.77E-02	7.05E-03	0.00E+00	1.18E-03	5.23E-04	1.53E-04	-1.29E-01

*GWP 100 according IPCC AR5; ADP fossil according to CML 2001 v4.8 (August 2016); all other indicators according to TRACI 2.1.

5. LCA Interpretation

The present interpretation is intended to provide further information in support of results reported in Table 11.

The LCA study shows that the highest contribution to the overall impacts comes from the manufacturing stage A1-A3 in all impact categories, whereas the downstream (C1-C4) is of minor relevance and/or negligible. With regard to the upstream, impacts are driven by raw materials and namely by primary ingots for all impact categories, with the exception of the ODP where the first contributor is the set of alloying elements. Manufacturing contributes to the impacts of the upstream stages in a range running from 6% to 43%. The relative contribution of the different processes to the upstream stage (A1-A3) is reported in Figure 2.

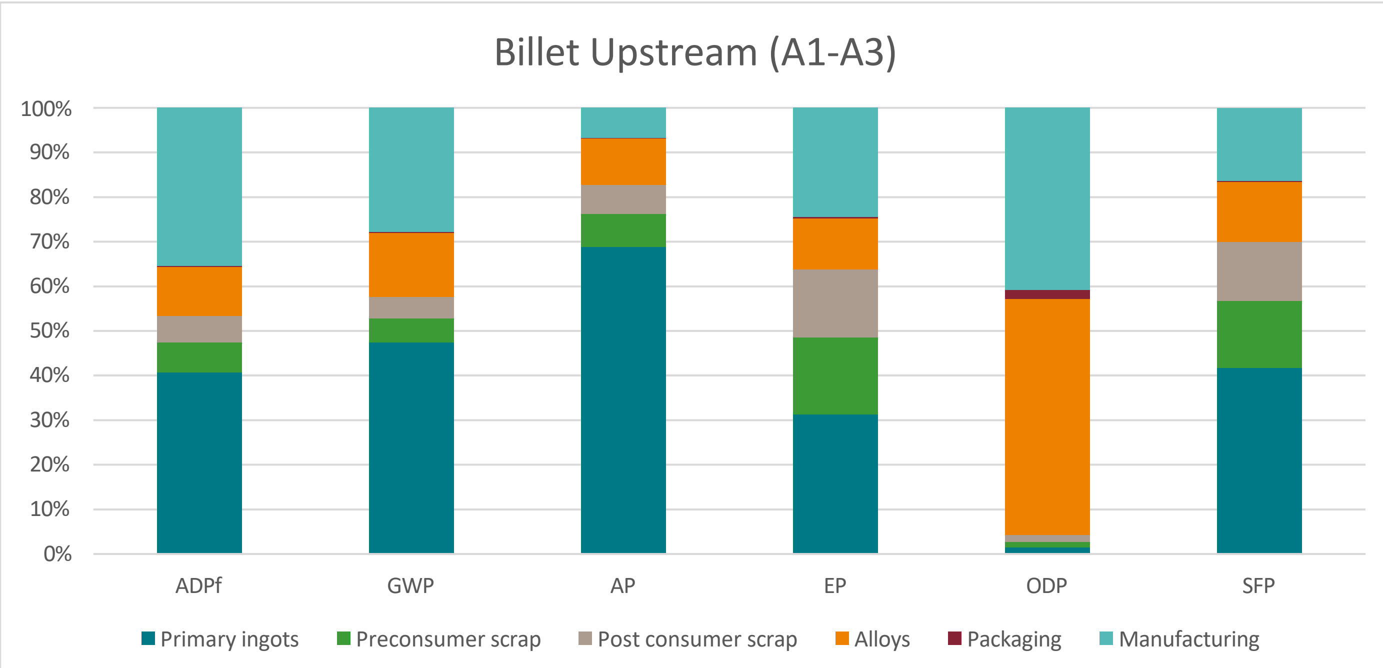


Figure 2. Relative contribution to upstream process

6. Additional Environmental Information

Environment and Health During Manufacturing

The entire manufacturing process is monitored by management systems certified to ISO 9001 and IATF 16949, with regard to quality-related product requirements. All statutory obligations with regard to occupational and workplace safety and the environment have been complied with throughout the entire manufacturing process. This is ensured by management systems certified to ISO 14001 and ISO 45001 continuously monitored internally and by external accredited certification bodies.

Environment and Health During Installation

All statutory obligations with regard to occupational and workplace safety and the environment have been complied with throughout the entire manufacturing process. This is ensured by management system certifications to ISO 14001 and ISO 45001 continuously monitored internally and by external accredited certification bodies.

Environmental Activities and Certifications

Hydro North America maintains corporate certification to ISO 9001, IATF 16949, ISO 14001, ISO 45001 and the ASI performance standard.

Further Information

See https://www.hydro.com/ for further information.

7. References

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