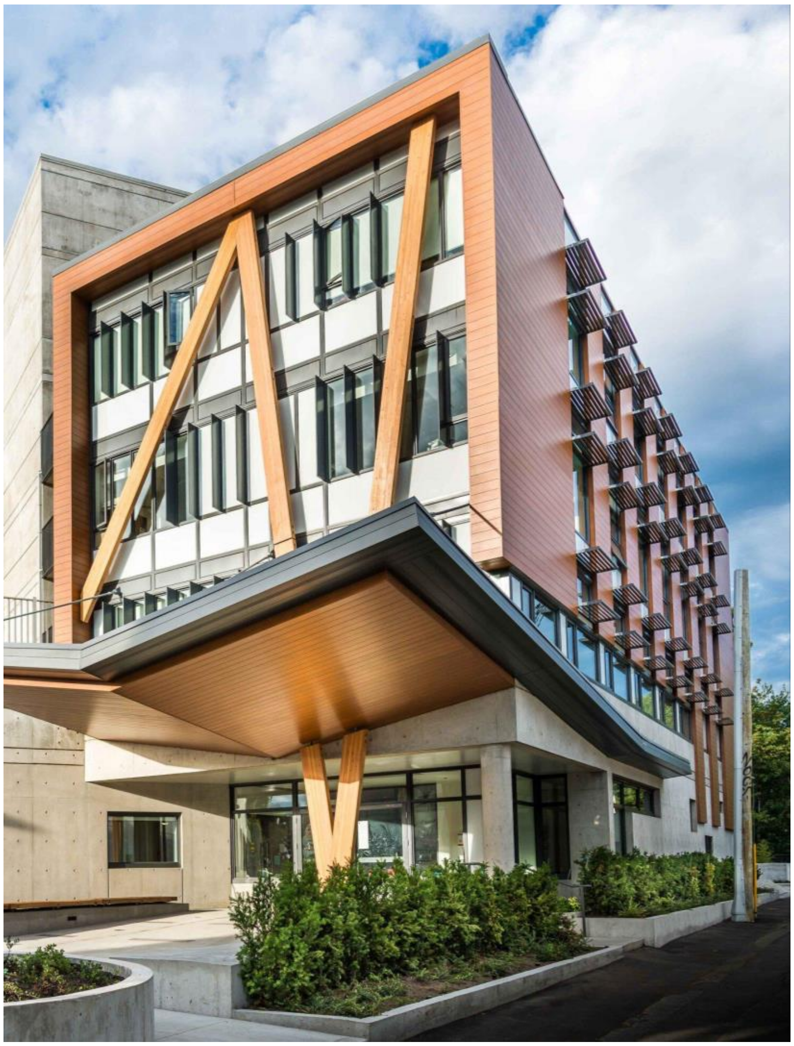
ENVIRONMENTAL PRODUCT DECLARATION

LONGBOARD ARCHITECTURAL PRODUCTS

EXTRUDED ALUMINUM 50% RECYCLED CONTENT



Longboard® Architectural Products Inc. (Longboard) provides the design and construction community with inspiring architectural products for thoughtful spaces. Founded in 2005, Longboard manufactures top-quality extruded aluminum profiles that are offered in a variety of solid color and woodgrain powder-coated finishes for interior and exterior spaces.

Longboard's goal is to drive product innovation and excellence, provide radical client care and industry-best lead times, and advance sustainability in construction by creating products that reduce carbon emissions over their life cycle. Longboard is ICC ESR-4183 and ESR-4184 certified, manufactured in North America, and is headquartered in British Columbia, Canada.

For more information, visit: www.longboardproducts.com

CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

ENVIRONMENTAL PRODUCT DECLARATION

LONGBOARD® ARCHITECTURAL PRODUCTS

According to ISO 14025, and ISO 21930:2017

Painted and decorated Aluminum Extrusions

Products of Aluminum and Aluminum Alloys

EPD Program and Program Operator Name, Address, Logo, and Website	UL Environment 333 Pfingsten Road Northbrook, Il 60611 https://www.ul.com https://spot.ul.com
General Program Instructions & Version	General Program Instructions v.2.5 March 2020
Manufacturer Name and Address	Longboard Architectural Products Inc. 1777 Clearbrook Road, Unit 120 Abbotsford, BC V2T 5X5
Declaration Number	4790062561.102.1
Declared Product & Functional Unit or Declared Unit	Extruded Aluminum, painted and decorated, 1000 kg
Reference PCR and Version Number (Part A and B)	ULE PCR Part A for Life Cycle Assessment Calculation Rules and Report Requirements v3.2, ULE PCR Part B for Aluminum Construction Products
Description of Product's Intended Application and Use (as Identified when Determining Product RSL, If Applicable)	N/A
Product RSL Description (if Appl.)	Extruded Aluminum, 50% recycled, painted, and decorated
Markets of Applicability	North America
Date of Issue	April 1, 2022
Period of Validity	5 Years
EPD Type	Industry specific
Dataset Variability	[Industry-average only; mean, range of recycled content]
EPD Scope	Cradle to gate with options modules C1-C4, module D included
Year(s) of reported primary data	2021
LCA Software & Version Number	GaBi v10
LCI Database(s) & Version Number	GaBi 2021 (CUP 2021.1)
LCIA Methodology & Version Number	IPCC AR5 (GWP), TRACI 2.1

The sub-category PCR review was conducted by:	UL Environment PCR Review Panel epd@ul.com
This declaration was independently verified in accordance with ISO 14025: 2006. The UL Environment "Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report," serves as the core PCR ☐ INTERNAL ☒ EXTERNAL	Cooper McCollum, UL Environment
The EPD conforms with (select one):	☒ ISO 21930:2017
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by: This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Sphera Solutions Inc
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	James Mellentine, Thrive ESG

LIMITATIONS

The environmental impact results of aluminum construction products in this document are based on a declared unit and therefore do not provide sufficient information to establish comparisons. The results shall not be used for comparisons without knowledge of how the physical properties of the aluminum product impact the precise function at the construction level. The environmental impact results shall be converted to a functional unit basis before any comparison is attempted. See Section 3.7 and 5.1 for additional EPD comparability guidelines.

Environmental declarations from different programs (ISO 14025) may not be comparable.

Product Definition and Information

Description of Organization

Longboard Architectural Products Inc. (Longboard) is a manufacturer, primarily focused on interior and exterior architectural products for commercial and high-end residential buildings. With their technical expertise, Longboard is well positioned to enable and assist architects, designers, general contractors and installers to design and build buildings that are energy efficient and that will reduce carbon emissions, minimize waste and at the same time enhance occupant comfort levels, wellness and health.

Product Description

Longboard products are used in a variety of building and construction applications, including: Open & Closed Joint Cladding, Screens, Panels & Metal Ceilings. Longboard's responsibility is to manufacture their product to the highest standards. Non-combustible, maintenance-free, doesn't warp, chip, will look fantastic in the built environment for 20+ years to come.

Table 1 Product description

Name	Value
Product Name	Longboard Architechtural Products
Product Description	Aluminum extrusions: Powdercoated and decorated
Classification	Semi-fabricated, construction product
Classification (Semi-Fabricated Products Only)	Raw materials:Aluminum billet Output: Aluminum Extrusions
Finishing	Powdercoating and decorating via sublimaion technology
Alloy Group	6XXX series wrought aluminum (6063)

Product Average

This EPD covers the production of extruded aluminum with decorated surface finish after powder coating. The results for the final product are calculated for the Longboard Architectural Products production site located in Abbotsford, BC, Canada.

Properties of Declared Product as Delivered

Technical data for the studied product can be found in the table below.

Table 2 Technical data of the product

Name	Value	Unit
Density	2700	kg/m3
Melting point	616-654	°C
Electrical conductivity at 20°C	31.25	m/Ωmm^2
Thermal conductivity	209	W/(mK)
Coefficient of thermal expansion at Define °C	24	$10^{-6}K^{-1}$
Modulus of elasticity	68.9 x 10^3	N/mm^2
Shear modulus	25.8 x 10^3	N/mm^2
Specific heat capacity	0.90	kJ/kgK
Hardness	60	HB
Yield strength	145	N/mm^2
Ultimate tensile strength	186	N/mm^2
Breaking elongation	12	%

Table 3 6063 aluminum alloy chemical composition (% by mass) as per Teal Sheet (AA, 2018)

	Si	Cu	Mn	Mg	Cr	Zn	Ti	Others (each)	Others (total)	Aluminum
Minimum	-	-	-	0.45	-	-	-	-	-	remainder
Maximum	0.35	0.10	0.10	0.90	0.10	0.10	0.10	0.05	0.15	remainder

Table 4 Primary and Recycled Material Composition

6063		Value (by mass)
Primary material		50%
Recycled material	Pre-consumer	50%
	Post-consumer	0%

Base and Ancillary Material

Table 5 Base and ancillary material

Name	Value
Aluminum	96.75%
Paint and Decorating	3.25%

Industry Standards

- AAMA 509, AAMA 501.1-17,
- ASTM C423, ASTM E8, ASTM E84, ASTM E136, ASTM E283, ASTM E331, ASTM E1477, ASTM E2768,
- CAN/ULC S102, CAN/ULC S114,
- ICC ESR, ISO 22196, LARR,
- TAS 201, TAS 202, TAS 203, EN 13501,
- EN ISO 1716, EN 13823,
- UL 723, WUI

Manufacturing

The Longboard aluminum extrusions covered by this EPD are produced in the Abbottsford plant in British Columbia, Canada.

The manufacturing process comprises the following production stages:

Extrusion:

- The aluminum extrusion process begins by loading the aluminum billet into the log furnace and pre heated to become malleable, then moved into the extrusion press container, where the hydraulic ram applies pressure to the billet to fill in the container. The pressure in the container forces the aluminum alloy through the die's opening in the shape of a fully formed profile. After emerging from the die, the long length of aluminum profile is unloaded onto extraction belts to cool down, then mechanically gripped on both ends and pulled to stretch to make the part straight.
- The aluminum profile is then moved and unloaded to discharge belts to the Finish Saw and cut according to the required lengths. Final visual inspection and flatness check is conducted to ensure compliance to quality requirements.
- The cut to length profiles are discharged to the stacker then moved to the oven and aged per required recipe to bring them to the required hardness. Aged aluminum profile is unloaded into the basket for and packed into bundles labeled with ticket for traceability.

Surface Treatment and Powder Coating:

- Pre-treatment: Aluminum profiles bundles are moved to powder coating line where the profiles are manually hung to undergo six stages of pretreatment process. This process used chemicals for degreasing, etching, rinse and chrome free application in order to remove grease, oil, dirt and other materials on the aluminum profile surface and prepare for proper powder-coating adhesion.
- Powder coating: After completing the pretreatment process, the aluminum profile moved through the powder coating process. A spray gun applies an electrostatic charge to the paint powder particles and applies uniformly across the aluminum profile surface. After coating application of the paint powder, the aluminum profile moves to the curing oven where with the addition of heat, the coating chemically reacts to seal the powder coat.

Decorating:

- Decorating process is a sublimation process when a woodgrain finish is required. In this process the powder coated aluminum profiles are bagged with a woodgrain pattern film. The bagged profiles will move through the oven. The heat from the oven will activate the inks on the film to a gas state which then embedded into the powder coating for the desired woodgrain finish.

The manufacturing process is illustrated in the diagram below.

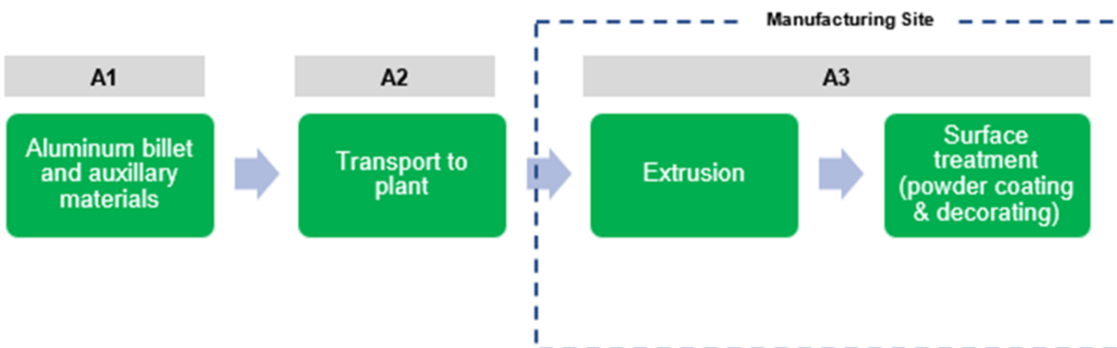


Figure 1 Breakdown of life cycle stages for aluminum extrusion

Product Processing/Installation

Installation is outside of the scope of this EPD.

Packaging

Wood, plastic and cardboard packaging are used in this study.

Recycling and Disposal

Aluminum extrusions are a highly efficient, sustainable building material. Aluminum is 100% recyclable and can be recycled repeatedly. Recycled aluminum can be identical to smelted aluminum but requires a fraction of energy to manufacture. In building and construction, aluminum scrap has a recycling rate of 95% (UNEP, 2011) (AEC, 2021).The remaining 5% is sent to landfill.

Table 6 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

Environment and Health

Product manufacturing: Plant emissions to air/soil/water are monitored (if applicable) and comply with local laws.

Product use: Longboard products are not expected to create exposure conditions that exceed safe thresholds for health impacts to humans or flora/fauna under normal operating conditions.

Methodological Framework

Declared Unit

The declared unit is 1,000 kg of aluminum extrusion as produced at the factory.

Table 7 Declared unit

Name	Value	Unit
Declared unit	1	metric ton
Density (typical)	2700	kg/m^3

System Boundary

Per the PCR, 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.

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 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 related to aluminum recycling reported in module D. The following datasets in Table 8 were used to calculate the associated aluminum credit:

Table 8 Background datasets used for module D

Background datasets (Sphera, 2021)	Reference year
RNA: Secondary aluminum ingot (95% recycled content) AA	2016
RNA: Primary aluminum ingot AA	2016

The net scrap approach is based on the perspective that material that is recycled into secondary material at end of life will replace for an equivalent amount of virgin material. Hence a credit is given to account for this material substitution. However, this also means that burdens equivalent to this credit should be assigned to scrap used as an input to the production process, with the overall result that the impact of recycled granulate is the same as the impact of virgin material. This approach rewards end of life recycling but does not reward the use of recycled content. A schematic is presented to further explain the net scrap approach that is considered in Aluminum end-of-life recycling. A schematic of the Module D calculation is presented in Figure 2.

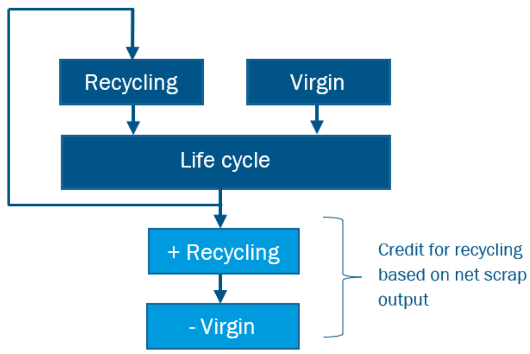


Figure 2 Schematic for the net-scrap approach (credit given at the end-of-life)

Table 9 represents the system boundary and scope.

Table 9 System boundary modules included and excluded from the study

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)																
PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport	Construction-installation process	Use	Maintenance	Repair	Replacement1	Refurbishment 1	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	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 C1 module.

Time coverage: Longboard Architectural Products primary data represent production within calendar year 2021. Background data for upstream and downstream processes (i.e., raw materials, energy resources, transportation, and ancillary materials) were obtained from the GaBi 10 (CUP 2021.1) databases.

Technology coverage: Data were collected for the production of painted (powder-coated), decorated and mill-finish aluminum extrusions at Longboard's facility in British Columbia, Canada.

Geographical coverage: Longboard manufactures aluminum extrusion products at Abbottsford, British Columbia, 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.

Allocation

No multi-output (i.e., co-product) allocation was performed in the foreground system of this study.

Allocation of background data (energy and materials) taken from the GaBi 2021 databases is documented online at https://sphera.com/wp-content/uploads/2020/04/Modeling-Principles-GaBi-Databases-2021.pdf. Also please refer to the 2022 LCA report on semi-fabricated aluminum. for more information : https://www.aluminum.org/sites/default/files/2022-01/2022_Semi-Fab_LCA_Report.pdf

Per the PCR guidance, recycling and recycled content in the cradle-to-gate system are modeled using the cut-off rule (a.k.a, the recycled content rule). All materials that are recycled from unit processes are considered to have left the system boundary. Recycled content is modeled in the system only when the percent of recycled content was specified in the material purchase.

Cut-off Criteria

In the case of data gaps for unit processes, the cut-off criteria as defined by ISO 21930 were applied. All available energy and material flow data have been included in the model. In cases where no matching life cycle inventories are available to represent a flow, proxy data have been applied based on conservative assumptions regarding environmental impacts.

Data Sources

The LCA model was created using the GaBi 10 software system for life cycle engineering, developed by Sphera (Sphera, 2021). Background life cycle inventory data for raw materials and processes were obtained from the GaBi 2021 database (CUP 2021.1). Primary manufacturing data were provided by Longboard Architectural Products.

Longboard imports primary Aluminum billet from Australia, Washington (USA) and Quebec (Canada). Industry average Aluminum Association (AA) dataset for primary Aluminum ingot is used to represent all primary Aluminum in this study. Table 10 represents the carbon intensity and share of electricity for primary Aluminum ingot (AA dataset) used in this analysis.

Table 10 Data sources, origin and carbon intensity for primary Aluminum

Dataset used in the calculation	Geographic origin	Carbon intensity per 1 kg ($kgCO_2eq/kwh$)	Power mix for Smelting for North American Primary Aluminum	Share of power in the mix	kwh / kg with share
Primary Aluminum ingot (AA)	North America	0.015	Hydro	79.99%	9.60E+00
		1.100	Coal	16.91%	4.43E-01
		0.981	Oil	0.01%	4.16E-08
		0.546	Natural Gas	2.69%	1.13E-02
		0.005	Nuclear	0.40%	2.51E-04

Data Quality

A variety of tests and checks were performed by the LCA practitioner throughout the project to ensure high quality of the completed LCA. Checks included an extensive internal review of the project specific LCA models developed as well as the background data used. A full data quality assessment is documented in the background report.

Period Under Review

Primary data were collected for sublimed (decorated) longboard production during the year 2021. Background data for steel coil production was taken from AA and represents steel production during 2016. This analysis is intended to represent production in 2020.

Estimations and Assumptions

All of the raw materials and energy inputs have been modeled using processes and flows that closely follow actual production data on raw materials and processes. All reported material and energy flows have been accounted for.

No significant assumptions have been made beyond the aforementioned.

Proxy data were applied to some materials where no matching life cycle inventories were available, as documented in the background report.

Life Cycle Assessment – Results

The results from the Longboard Aluminum extrusions 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.

Longboard Aluminum Extrusions

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.

Table 11 LCIA results for 1,000 kg of longboard aluminum extrusions (50% recycled aluminum)

Impact Category	Unit	A1	A2	A3	C1	C2	C4	D
				LIFE CYCLE IMPACTS ASSESSMENT (LCIA) RESULTS				
GWP	kg CO_2 eq	5.76E+03	1.11E+02	8.80E+02	-	1.65E+01	3.57E+00	-5.18E+03
ODP	kg CFC 11 eq.	3.57E-12	2.12E-14	3.36E-06	-	3.44E-15	1.22E-14	-1.74E-12
AP	kg SO_2 eq.	2.63E+01	1.17E+00	2.12E+00	-	3.18E-02	1.57E-02	-2.43E+01
EP	kg N eq.	5.87E-01	8.28E-02	2.42E-01	-	4.56E-03	2.03E-02	-5.38E-01
SFP	kg O_3 eq.	2.15E+02	3.86E+01	3.84E+01	-	7.20E-01	1.95E-01	-1.99E+02
ADPf	MJ LHV surplus energy	5.27E+03	2.04E+02	2.03E+03	-	3.23E+01	5.02E+00	-3.44E+03
				RESOURCE USE INDICATORS				
RPRe	MJ LHV	3.27E+04	5.23E+01	1.88E+03	-	1.00E+01	4.47E+00	-3.37E+04
RPRm	MJ LHV	-	-	1.13E+03	-	-	-	-
NRPRe	MJ LHV	5.82E+04	1.54E+03	1.39E+04	-	2.44E+02	4.37E+01	-4.74E+04
NRPRm	MJ LHV	2.09E+03	-	3.09E+02	-	-	-	-
SM	MJ LHV	5.76E+02	-	-	-	-	-	4.11E-01
RSF	MJ LHV	-	-	4.67E-05	-	-	-	-
NRSF	MJ LHV	-	-	4.86E-04	-	-	-	-
RE	kg	-	-	-	-	-	-	-
FW	m^3	1.08E+02	2.20E-01	1.19E+01	-	4.29E-02	-1.72E+00	-1.12E+02
				OUTPUT FLOWS & WASTE FLOWS				
HWD	kg	3.23E-05	1.20E-07	6.24E-03	-	2.04E-08	4.14E-09	-2.88E-05
NHWD	kg	1.97E+03	1.26E-01	3.73E+01	-	2.24E-02	1.01E+02	-2.04E+03
HLRW	kg	6.25E-04	5.10E-06	3.67E-05	-	8.21E-07	1.12E-06	-4.06E-04
ILLRW	kg	5.16E-01	4.29E-03	3.43E-02	-	6.92E-04	9.44E-04	-3.25E-01
CRU	kg	-	-	-	-	-	-	-
MFR	kg	-	-	-	9.50E+02	-	-	4.98E-01
MER	kg	-	-	-	-	-	-	-
EE	kg	-	-	-	-	-	-	-

Comparability: 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.

Interpretation

The results represent the cradle-to-gate and end-of-life environmental performance of the surface treated aluminum extrusions. As shown in Figure-1, the results indicate that the impacts are dominated by the manufacturing stages (A1-A3). The largest contributions come from upstream aluminum production (A1); the extrusion and finishing processes account for a relatively small part of the manufacturing impact in comparison.

The credits at the end-of-life (Module D) also play a role in the life cycle; if a higher rate is used, the credit will increase, thus lowering the total life-cycle impacts.

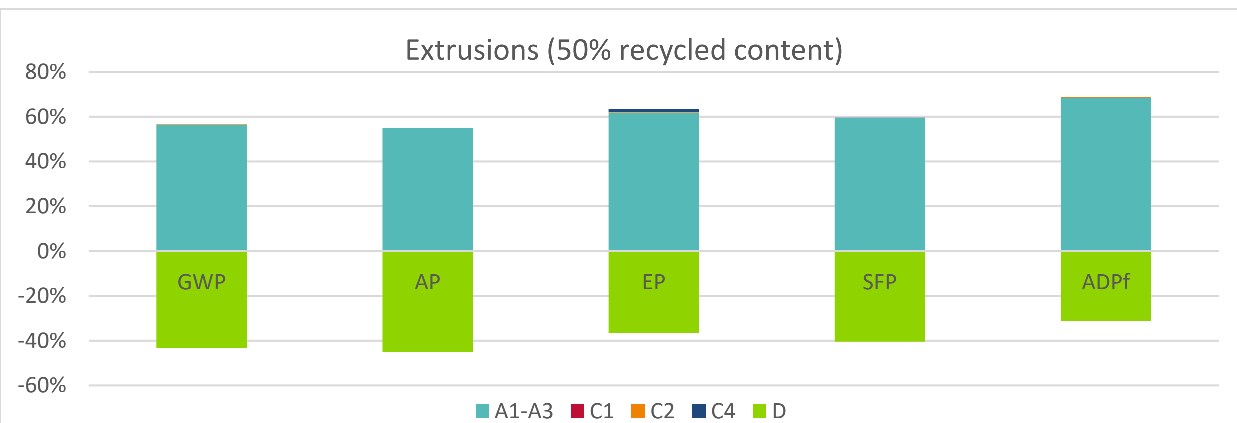


Figure 3 Results for Longboard Aluminum Extrusions by life cycle stages (IPCC AR5 & TRACI 2.1)

(GWP = Global warming potential (IPCC); AP = Acidification potential; EP = Eutrophication potential; ODP = Stratospheric ozone layer depletion potential; FF = Resources, Fossil fuels; SFP = Smog formation potential)

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Contact Information

Study Commissioner

LONGBOARD® ARCHITECTURAL PRODUCTS

Longboard Architectural Products Inc.
1777 Clearbrook Road, Unit 120
Abbotsford, BC V2T 5X5
www.longboardproducts.com

LCA Practitioner

sphera™

Sphera Solutions, Inc.
130 E Randolph St, #2900
Chicago, IL 60601
https://sphera.com/contact-us/
www.sphera.com