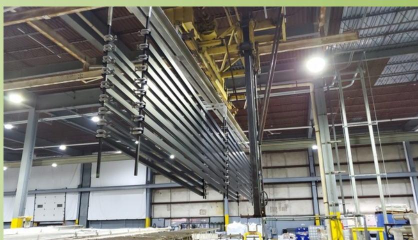


Declaration Owner

Keymark Corporation Fonda
1188 Cayadutta St
Fonda, NY 12068
United States of America
https://www.keymarkcorp.com,
(518) 853-3421

Product:

Anodized Aluminum Extrusion

Declared Unit

One (1) metric ton of aluminum product

EPD Number and Period of Validity

SCS-EPD-10653
EPD Valid July 08, 2026 through July 07, 2031

Product Category Rule

Product Category Rules for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements, UL 10010. V 4.0. March 2022.

Part B: Aluminum Construction Product EPD Requirements. UL 10010 – 38. V 1.0. February 2022

Program Operator

SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608
+1.510.452.8000 | www.SCSglobalServices.com

EPD is generated with the AEC EPD and PCF Generator Tool, developed by SCS Global, March 2025

Declaration owner:	Keymark Corporation Fonda
Address:	1188 Cayadutta St, Fonda NY 12068
Declaration Number:	SCS-EPD-10653
Date of Issue	July 08, 2026
Declaration Validity Period:	EPD Valid July 08, 2026 through July 07, 2031
Program Operator:	SCS Global Services
General Program Instructions:	SCS Program Operator Manual v.12, December 2023
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	SCS Global Services
Product's Intended Application:	This product is primarily used for building and construction, agriculture, filtration, automotive, and various other applications.
Declared Unit	One (1) metric ton of aluminum extrusion product
Product RSL:	n/a
Markets of Applicability:	North America
EPD Type:	Product Specific
Dataset Variability:	Average
EPD Scope:	Cradle to Gate with Modules C1-C4 and Module D
Year of Primary Data:	2024
LCA Software and Version:	SCS eCompass Suite – LCA Tool, version 1.0
LCI Database and Version:	Ecoinvent 3.10, 2024
LCIA Methodology and Version:	TRACI v2.1
Third Party Verification of EPD Tool	☐ internal ☒ external
EPD Tool Verifier	Lindita Bushi, PhD. Athena Sustainable Materials Institute
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☐ internal ☒ external
LCA Reviewer:	Lindita Bushi, Athena Sustainable Materials Institute
Part A Product Category Rule:	Product Category Rules for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements, UL 10010. V 4.0. March 2022.
Part A PCR Review conducted by:	Lindita Bushi, PhD; Hugues Imbeault-Tetreault; and Jack Geibig
Part B Product Category Rule:	PCR Guidance for Building-Related Products and Services. Part B: Aluminum Construction Product EPD Requirements. UL 10010 – 38. February 2022
Part B PCR Review conducted by:	Lindita Bushi, PhD; James Mellentine; and Nicholas Santero, PhD, PE
Independent verification of the declaration and data, according to ISO 14025, ISO 21930, and the PCR	☐ internal ☒ external
EPD Verifier:	Lindita Bushi, Athena Sustainable Materials Institute

Scope of Results Reported: The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions. Accuracy of Results: Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy. Comparability: The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled. In accordance with ISO 21930:2017, EPDs are comparable only if they comply with the core PCR, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works. This EPD was created using the AEC EPD Generator Tool, March 2025, developed March 2025 by SCS Global Services.

Table Of Contents

1. Keymark Corporation Fonda

Keymark Corporation Fonda is an aluminum extruder located in New York State and has been providing quality aluminum extrusions to an array of U.S. Industries for over since 1965.

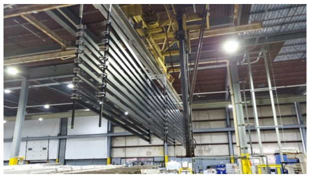
2. Products

2.1 PRODUCT DESCRIPTION

The Anodized Aluminum Extrusion in this study is used primarily for building and construction, agriculture, filtration, automotive, and various other applications.**.** Table 1 below provides an in-depth product characterization.

Table 1. *Technical characteristics of Keymark Corporation Fonda* Anodized Aluminum Extrusion *.*

Parameter	Description
Product Name	Anodized Aluminum Extrusion
Product Description	This product is a mill finish extrusion that is then dipped into tanks and employs electrolytic oxidation of the aluminum surface to produce a protective oxide coating.
Classification	ingot/billet
Finishing	Extrusion, Anodization
Alloy Group	6000 series



2.2 PRODUCT SPECIFICATION

Keymark Corporation Fonda sells Anodized Aluminum Extrusion in the following forms:
This product is compliant with AAMA 611-17 for Class I and AAMA 611-17 Class II.

2.3 PRODUCT FLOW DIAGRAM

A flow diagram illustrating the production processes and life cycle phases included in the scope of the EPD is provided below.

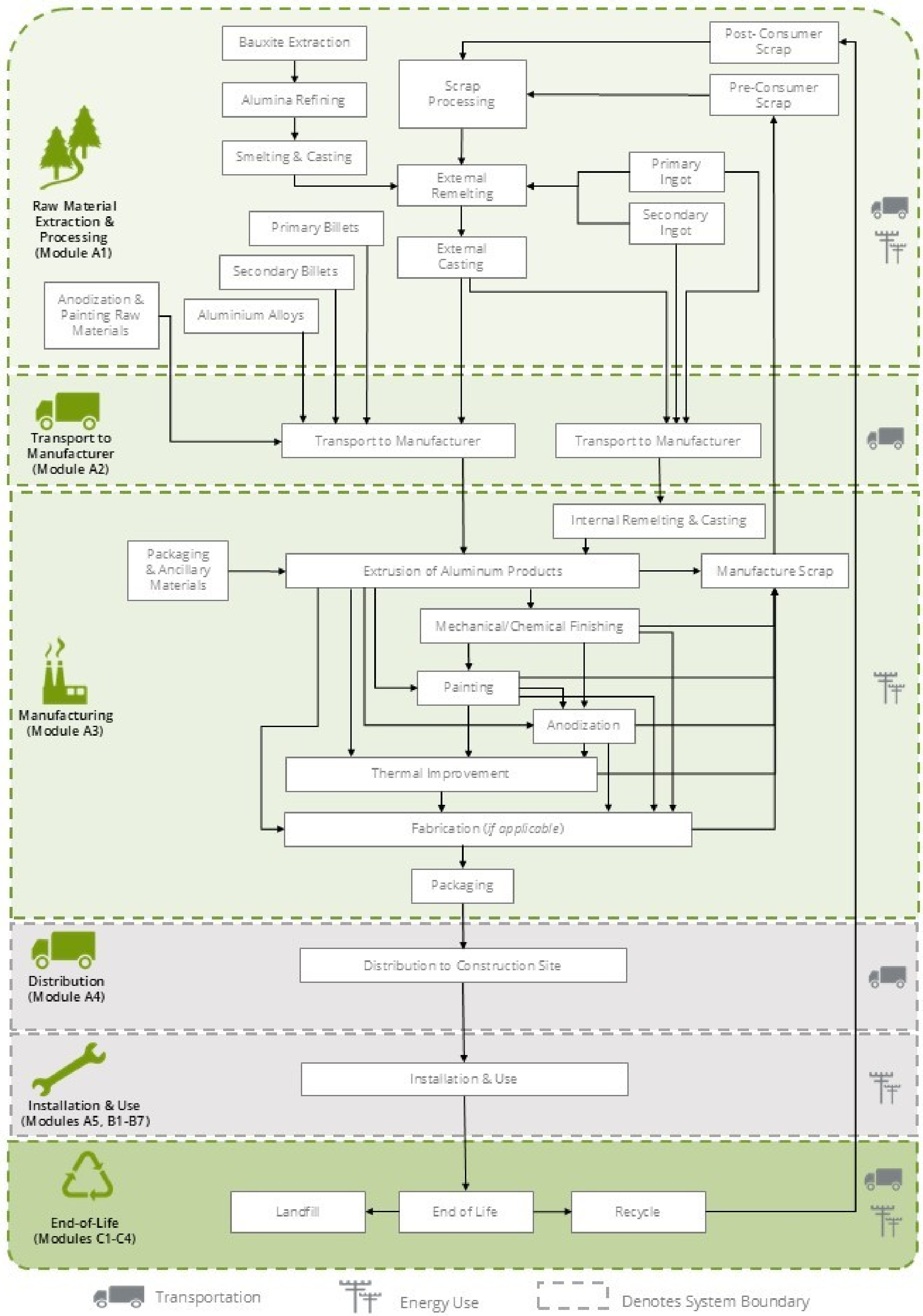


Figure 1. *Flow Diagram for the life cycle of the Keymark Corporation Fonda* Anodized Aluminum Extrusion *.*

2.4 INTENDED APPLICATION

The Anodized Aluminum Extrusion is used primarily for building and construction, agriculture, filtration, automotive, and various other applications..

2.5 MATERIAL COMPOSITION

The table below summarizes the components by weight and material type for the product line. Also presented are the material components as a percent of total mass and the recycled content percentage of each material.

In general 6000 series contains 0.30-1.80% Si, 0.10-0.70% Fe, 0.10-1.20% Cu, 0.10-1.10% Mn, 0.35-1.40% Mg, 0.10-0.40% Cr, 0.10-0.25% Zn, 0.10-0.20% Ti,

Table 2. *Material content and packaging content.*

Material	Mass Input (kg)	Mass Final Product (kg)	% Mass Final Product
Anodization			
Sodium hydroxide	7.874	7.014	0.7
Sulfuric Acid	107.257	95.548	9.55
Billet Casting			
Aluminum billet (primary, Canada)	74.662	66.511	6.65
Aluminum billet (primary, North America)	46.93	41.807	4.18
Aluminum scrap (post-industrial)	61.86	55.107	5.51
Aluminum Scrap (pre-consumer)	497.634	443.308	44.33
Copper	0.144	0.128	0.01
Magnesium	0.824	0.734	0.07
Manganese	0.236	0.21	0.02
Salt Flux	0.862	0.768	0.08
Silicon	0.272	0.242	0.02
Ti Boron	0.879	0.783	0.08
Extrusion			
Aluminum billet (Imported - Rest of World)	5.195	4.628	0.46
Aluminum billet (primary, Canada)	233.725	208.209	20.82
Aluminum billet (primary, North America)	84.193	75.002	7.5
Total:	1122.55	1000.0	100.0%

Packaging	Value	Unit
Cardboard - International/US	9.438	kg
Foam	0.002	kg
Paper	0.511	kg
Plastic film	2.668	kg
Plastic strapping	0.228	kg
Tape	0.003	kg
Wood	24.176	kg

Anodized Aluminum Extrusion under normal conditions does not present inhalation, ingestion, or contact health hazards. The product does not include materials or substances which have potential route of exposure to humans or flora/fauna in the environment.

2.6 TECHNICAL DATA

Technical specifications for the Anodized Aluminum Extrusion in this study include what is listed in table 3 below.

Table 3. *Technical specifications.*

Parameter	Value	Unit
Gross Density	2750	kg/m^3
Melting Point	654.00	℃
Electrical Conductivity at 20℃	0.00000332	m/Ωmm^2
Thermal Conductivity	209.00	W/mK
Coefficient of thermal expansion	23.4 µm/m	per °C
Modulus of Elasticity	68.90	Gpa
Shear Modulus	26.00	GPa
Specific Heat Capacity	0.90	J/g - °C
Hardness	60.00	HB
Yield Strength Rp 0.2 min	110.00	Mpa
Tensile Strength Rm Min	151.00	MPa
Breaking Elongation	8.00	%

2.7 FURTHER INFORMATION

Further information on the product can be found on the manufacturers' website at https://www.keymarkcorp.com.

3. LCA: Methodological Framework

3.1 DECLARED UNIT

The declared unit used in the study is one (1) metric ton of aluminum product, consistent with the PCR.

3.2 SYSTEM BOUNDARY

The scope of the EPD is cradle-to-gate with options (A1-A3 with end of life and module D). The life cycle phases included in the product system boundary are shown below.

Table 4. *Life cycle phases included in the Keymark Corporation Fonda Anodized Aluminum Extrusion product system boundary.*

Product			Construction Process		Use							End-of-life				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B1	B3	B4	B5	B6	B7	C1	C2	C3	C4	D

Raw material extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery and/or recycling potential
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

X = Module Included | MND = Module Not Declared

Cut-off and allocation procedures are described below and conform to the PCR and ISO standards.

3.3 ALLOCATION

This study follows the allocation guidelines of ISO 14044 and allocation rules specified in the PCR and minimized the use of allocation wherever possible.

With respect to aluminum scrap, the 100-0 recycled content approach is used in which the recycled material bears only the burden of any processing from waste material.

Mass allocation was deemed the most accurate and reproducible way of calculating the energy and material requirements for the manufacture of the aluminum and aluminum products. Primary data for resource use (e.g., electricity, natural gas, water), waste/co-products, and emissions released, are allocated on a mass-basis as a fraction of total annual production.

The transportation from primary producer of material components to manufacturing facility is based on primary data provided by Keymark Corporation Fonda, including modes, distances, and amount of material transported. Transportation was allocated based on the mass and distance the material was transported.

Allocation of background data (energy and materials) taken from the ecoinvent database is documented online at System Models (ecoinvent.org).

3.4 CUT-OFF RULES

In the case of data gaps for unit processes, the cut-off criteria as defined by the ISO 21930 Standard 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. No known flows are deliberately excluded from this EPD.

3.5 DATA SOURCES

Primary data were provided by Keymark Corporation Fonda for the 12 months ending on December 31, 2024. The sources of secondary LCI data are Aluminum Association EPD, ecoinvent 3.9.1, ecoinvent 3.10.

Table 5. *Data sources for the Keymark Corporation Fonda Anodized Aluminum Extrusion facility(ies).*

Flow	Dataset	Geography	Data Source	Publication Date
Anodization				
Electricity - US-NPCC	market for electricity, medium voltage|electricity, medium voltage|Cutoff, U-US-NPCC	United States of	ecoinvent 3.10	2023

		America		
Natural Gas	heat production, natural gas, at industrial furnace >100kW|heat, district or industrial, natural gas|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Defoamer	market for polydimethylsiloxane|polydimethylsiloxane|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Sodium hydroxide	market for sodium hydroxide, without water, in 50% solution state|sodium hydroxide, without water, in 50% solution state|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Sulfuric Acid	market for sulfuric acid|sulfuric acid|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Other waste to recovery	treatment of hazardous waste, hazardous waste incineration, with energy recovery|hazardous waste, for incineration|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Caustic solids/sludge waste	market for hazardous waste, for incineration|hazardous waste, for incineration|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Anodized Aluminum Extrusion recycling	market for scrap aluminium|scrap aluminium|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Anodized Aluminum Extrusion landfill	treatment of waste aluminium, sanitary landfill|waste aluminium|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Billet Casting				
Electricity - US-NPCC	market for electricity, medium voltage|electricity, medium voltage|Cutoff, U-US-NPCC	United States of America	ecoinvent 3.10	2023
Natural Gas	heat production, natural gas, at industrial furnace >100kW|heat, district or industrial, natural gas|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Bone ash	market for calcium chloride|calcium chloride|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Boron nitride	market for boron trifluoride|boron trifluoride|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Filters	market for air filter, decentralized unit, 180-250 m3/h|air filter, decentralized unit, 180-250 m3/h|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Graphite Lubricant	market for graphite|graphite|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Lubricants including cutting fluids	market for lubricating oil|lubricating oil|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Aluminum billet (primary, Canada)	aluminium production, primary, ingot|aluminium, primary, ingot|Cutoff, U-CA	Canada	ecoinvent 3.9.1	2022

Aluminum scrap (post-industrial)	market for aluminium scrap, new|aluminium scrap, new|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Aluminum Scrap (pre-consumer)	market for aluminium scrap, new|aluminium scrap, new|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Copper	market for copper, cathode|copper, cathode|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Magnesium	market for magnesium|magnesium|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Manganese	market for manganese|manganese|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Salt Flux	market for salt|salt|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Silicon	market for silicon, metallurgical grade|silicon, metallurgical grade|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Ti Boron	market for titanium|titanium|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Tap Water	market for tap water|tap water|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Caustic solids/sludge waste	market for hazardous waste, for incineration|hazardous waste, for incineration|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Waste to landfill	market for inert waste, for final disposal|inert waste, for final disposal|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Dross to recovery	treatment of hazardous waste, hazardous waste incineration, with energy recovery|hazardous waste, for incineration|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Steel dies to recycling	treatment of waste reinforcement steel, recycling|waste reinforcement steel|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Waste water to sewer	market for wastewater, average|wastewater, average|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Aluminum billet (primary, North America)	Aluminum Association EPD, UL Environment, #4790545973.102.1	North America	Aluminum Association EPD	2022
Generic Truck	market for transport, freight, lorry 16-32 metric ton, EURO4|transport, freight, lorry 16-32 metric ton, EURO4|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Extrusion				
Electricity - US-NPCC	market for electricity, medium voltage|electricity, medium voltage|Cutoff, U-US-NPCC	United States of America	ecoinvent 3.10	2023
Natural Gas	heat production, natural gas, at industrial furnace >100kW|heat, district or industrial, natural gas|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Ammonia anhydrous	market for ammonia, anhydrous, liquid|ammonia, anhydrous, liquid|Cutoff, S/RoW	World	ecoinvent 3.10	2023

Bulk O2	market for oxygen, liquid|oxygen, liquid|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Hydraulic oil	market for lubricating oil|lubricating oil|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Lubricants including cutting fluids	market for lubricating oil|lubricating oil|Cutoff, S/RoW	World	ecoinvent 3.10	2023
steel die	market for steel, low-alloyed, hot rolled|steel, low-alloyed, hot rolled|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Aluminum billet (Imported - Rest of World)	aluminium, ingot, primary, import from unspecified|aluminium, primary, ingot|Cutoff, U-IAI Area, North America	World	ecoinvent 3.10	2023
Aluminum billet (primary, Canada)	aluminium production, primary, ingot|aluminium, primary, ingot|Cutoff, U-CA	Canada	ecoinvent 3.9.1	2022
Aluminum billet (primary, North America)	Aluminum Association EPD, UL Environment, #4790545973.102.1	North America	Aluminum Association EPD	2022
Tap Water	market for tap water|tap water|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Waste to landfill	market for inert waste, for final disposal|inert waste, for final disposal|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Waste water to sewer	market for wastewater, average|wastewater, average|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Ship	market for transport, freight, sea, container ship|transport, freight, sea, container ship|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Packaging				
Electricity - US-NPCC	market for electricity, medium voltage|electricity, medium voltage|Cutoff, U-US-NPCC	United States of America	ecoinvent 3.10	2023
Natural Gas	heat production, natural gas, at industrial furnace >100kW|heat, district or industrial, natural gas|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Cardboard - International/US	market for corrugated board box|corrugated board box|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Foam	market for polystyrene foam slab|polystyrene foam slab|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Paper	market for kraft paper|kraft paper|Cutoff, S/RoW	World	ecoinvent 3.10	2023
Plastic film	market for packaging film, low density polyethylene|packaging film, low density polyethylene|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Plastic strapping	market for polypropylene, granulate|polypropylene, granulate|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Tape	market for polypropylene, granulate|polypropylene, granulate|Cutoff, S/GLO	Global	ecoinvent 3.10	2023
Wood	market for plywood|plywood|Cutoff, S/RoW	World	ecoinvent	2023

			3.10	

3.6 DATA QUALITY

The data quality assessment addressed the following parameters: time-related coverage, geographical coverage, technological coverage, precision, completeness, representativeness, consistency, reproducibility, sources of data, and uncertainty.

Table 6. *Data quality assessment for the Keymark Corporation Fonda Anodized Aluminum Extrusion product system.*

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	The manufacturer provided primary data on product manufacturing for the Keymark Corporation Fonda on annual production for the 12 months ending on December 2024. Representative datasets (secondary data) for upstream and background processes are taken from Ecoinvent and represent an average of at least one year's worth of data collection.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Electricity use for product manufacture is modeled using representative data from Ecoinvent. Surrogate data used in the assessment are representative of global or European operations and are considered sufficiently similar to actual processes.
Technology Coverage: Specific technology or technology mix	Data are generally representative of the actual technologies used for energy generation, processing, transportation, and manufacturing operations. Representative component datasets, specific to the type of material, are used to represent the actual processes, as appropriate.
Precision: Measure of the variability of the data values for each data expressed	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one more years and over multiple operations, which is expected to reduce the variability of results.
Completeness: Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of the products. In some instances, surrogate data used to represent upstream and downstream operations may be missing some data which is propagated in the model. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data used in the assessment represents typical or average processes as currently reported from multiple data sources and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is considered to be high. Data sources of similar quality and age are used; with a bias towards Ecoinvent v3.10 data where available. Different portions of the product life cycle are equally considered.

Data Quality Parameter	Data Quality Discussion
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Based on the description of the data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	Data representing energy use at the Keymark Corporation Fonda represent a 12-month average and are considered of high quality due to the length of time over which these data are collected, as compared to a snapshot that may not accurately reflect fluctuations in production. For secondary LCI data, Ecoinvent v3.10 data are used.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the products and packaging is low. Actual supplier data for upstream operations was not available for all suppliers and the study relied upon the use of existing representative datasets. These datasets contained relatively recent data (10 years) but lacked geographical representativeness. Uncertainty related to the impact assessment methods used in the study are high. The impact assessment methodology includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

3.7 PERIOD UNDER REVIEW

The period of review for the Anodized Aluminum Extrusion produced at the Keymark Corporation Fonda facility(ies) were taken from January 01, 2024 through December 31, 2024.

3.8 COMPARABILITY

The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner’s assumptions, the source of the data used in the study, and the specifics of the product modeled.

3.9 UNITS

All data and results are presented using SI units.

3.10 ESTIMATES AND ASSUMPTIONS

The assessment relied on several assumptions related to production and end-of-life emissions. The major assumptions used in the study are described below.

- Keymark Corporation Fonda provided primary data for the production facility(ies) operations based on production data. The source of secondary LCI data are Aluminum Association EPD, ecoinvent 3.9.1, ecoinvent 3.10.
- Much of the upstream raw materials extraction and processing could not be modeled with actual process information. Representative data from the Ecoinvent LCI databases were utilized as appropriate. Some individual pieces were modeled by their major materials and approximate masses using representative products. A conservative approach was used for modeling product mass in cases with less certainty.
- Module A3: Manufacturing waste transport from facility to waste processing
    - Mode: Diesel-powered truck/trailer

  - Distance: 25 km

- Module C1: Demolition impacts are assumed to be negligible compared with the rest of the product life cycle and shall be reported as zero.
- Module C2: Product transport from building site to waste processing.
  - Mode: Diesel-powered truck/trailer.
  - Distance: 100 km.
- Module C4: Recovery and recycling rate – 95%, 5% to landfill.XXXXXV
- Aluminum classified as pre-consumer scrap is generated on site. Aluminum classified as post-industrial scrap is sourced from outside processors.

  Approximately
  7% of the aluminum input to the billet casting process is considered internal
  “run-around” scrap. In the absence of more specific material tracking, this
  study makes the conservative assumption to account for this internal scrap as
  if it were primary aluminum.

4. LCA: Technical Information and Scenarios

4.1 MANUFACTURING

The Anodized Aluminum Extrusion in this study is manufactured at the Keymark Corporation Fonda facility(ies).

Casting

The
casting process begins by melting aluminum ingots, aluminum scrap, and various
alloying elements at around 1400°. The molten aluminum is then poured into molds, where the aluminum is cooled within the mold using water and solidified into a round shape. The aluminum is then heat-treated in a
homogenizing furnace at around 1075°. After
homogenization, the aluminum billet is then cooled at a
rate of approximately 500° per hour. The
aluminum billets are then cut to a desired length.

Extrusion

The production stage starts with extraction and processing of aluminum ingot, billet, and ancillary materials, followed by the transportation of these materials to the plant. The extrusion manufacturing process takes cast extrusion billet (round bar stock, produced from direct chill molds and typically ranging in diameter from 6 to 14 inches) and produces extruded profiles. The process begins with an inline preheat furnace that elevates the temperature of the billet to a predetermined level, around 900°F depending on the alloy. If not already cut to length, the billet is then sheared and placed into a hydraulic press, which then forces the semi-plastic billet through a heated steel die to form the desired shape. The length of the resulting extrusion is dictated by the take-off tables. The extrusions are air cooled or water quenched, with specific quench parameters dependent on alloy and desired microstructure and properties. The extrusion is then clamped and stretched to straighten the profile. Subsequently, the stretched profile is cut to length and then aged for several hours at elevated temperature (e.g. 350°F) to achieve desired properties.

Painting

Extrusions to be painted are typically cleaned and then treated with a pre-coat in either a vertical or horizontal paint booth. Depending on the ultimate paint performance desired, a variety of pre-coats and primers may be employed. After pretreatment, the extrusions will be coated with a liquid or powder paint and baked. Various paint formulations may be used depending on the desired performance.

4.2 DISPOSAL

The table below lists the disposal channels evaluated in the study.

Table 7. *End-of-Life summary*

End-of-life		Unit	Value
Assumptions for scenario development			
Collection process	Collected separately	kg	0
	Collected with mixed construction waste	kg	1000
Recovery	Reuse	kg	0
	Recycling	kg	950.0
	Incineration	kg	0
	Incineration with energy recovery	kg	0
	Energy conversion	-	0
Disposal	Product of material for final deposition	kg	50.0
Removals of biogenic carbon (excluding packaging)		kg CO_2	0

4.14 BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY (D)

Module D recognizes the benefits and impacts that derive from the use of the aluminum scrap at the end of the product's service life. The methodology used to calculate module D is based on ISO 21930, Section 7.1.7.6 – Benefits and loads beyond the system boundary in optional supplementary module D.

The table below shows the net energy benefits for Reuse, Recovery and/or Recycling

Table 8. *Reuse, Recovery and/or Recycling*

Name	Unit	Value
Recycling rate of product	%	95.0
Recycled content of product	%	49.8
Net energy benefit from energy recovery from waste treatment as declared as exported energy in C3	MJ	0
Net energy benefit from thermal energy due to treatment of waste declared as exported energy in C4	MJ	0
Net energy benefit from material flow declared in C3 for energy recovery	MJ	0
Process and conversion efficiencies		N/A
Further assumptions for scenario development		N/A

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.

5. LCA: Results

Results of the Life Cycle Assessment are presented below. It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. All values in the tables below are rounded to three significant digits. The following impact indicators, specified by the PCR, are reported below:

Table 9. *Life Cycle Impact Assessment Indicators and characterization methods used.*

Impact Category	Unit	Characterization Method
Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources	MJ	CML v4.8 2016
Acidification Potential	kg SO2e	TRACI v2.1
Eutrophication Potential	kg Ne	TRACI v2.1
Ozone Depletion Potential	kg CFC11e	TRACI v2.1
Smog Formation Potential	kg O3e	TRACI v2.1
Global Warming Potential (GWP 100), IPCC 2013	kg CO2e	IPCC 2021

These impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes.

Table 10. *The following inventory parameters, specified by the PCR, are also reported.*

Resources	Unit	Waste and Outflows	Unit
RPR_E: Renewable primary resources used as energy carrier (fuel)	MJ, LHV	HWD: Hazardous waste disposed	kg
RPR_M: Renewable primary resources with energy content used as material	MJ, LHV	NHWD: Non-hazardous waste disposed	kg
$NRPR_E$: Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	HLRW: High-level radioactive waste, conditioned, to final repository	kg
$NRPR_M$: Non-renewable primary resources with energy content used as material	MJ, LHV	ILLRW: Intermediate- and low-level radioactive waste, conditioned, to final repository	kg
SM: Secondary materials	kg	CRU: Components for re-use	kg
RSF: Renewable secondary fuels	MJ, LHV	MR: Materials for recycling	kg
NRSF: Non-renewable secondary fuels	MJ, LHV	MER: Materials for energy recovery	kg
RE: Recovered energy	MJ, LHV	EE: Recovered energy exported from the product system	MJ, LHV
FW: Use of net freshwater resources	m^3	-	-

Table 11. *Life Cycle Impact Assessment (LCIA) results for the Keymark Corporation Fonda Anodized Aluminum Extrusion at the Keymark Corporation Fonda facility for life cycle stages A1 – A3. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits." Example table below*

Impact Category	Life cycle stage			
	A1	A2	A3	Total (A1-A3)
CML v4.8 2016				
Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (MJ)	3.52e+04	738	5.28e+04	8.87e+04
	39.675%	0.831%	59.494%	100%
TRACI v2.1				

Impact Category	Life cycle stage			
	A1	A2	A3	Total (A1-A3)
Acidification Potential (kg SO2e)	27.1	0.213	4.52	31.9
	85.156%	0.667%	14.176%	100%
Eutrophication Potential (kg Ne)	14.4	0.0583	5.61	20
	71.704%	0.291%	28.005%	100%
Ozone Depletion Potential (kg CFC11e)	7.27e-05	8.32e-07	0.00074	0.000813
	8.942%	0.102%	90.955%	100%
Smog Formation Potential (kg O3e)	237	5.63	101	344
	69.058%	1.64%	29.302%	100%
IPCC 2021				
Global Warming Potential (GWP 100), IPCC 2013 (kg CO2e)	4.82e+03	53	4.45e+03	9.33e+03
	51.73%	0.569%	47.702%	100%

Table 12. *Life Cycle Impact Assessment (LCIA) results for the Keymark Corporation Fonda Anodized Aluminum Extrusion at the Keymark Corporation Fonda facility for life cycle stages C1 – C4 and D. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Impact Category	Life cycle stage				
	C1	C2	C3	C4	D
CML v4.8 2016					
Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (MJ)	0	270	0.248	0.00944	-3.56e+04
TRACI v2.1					
Acidification Potential (kg SO2e)	0	0.0728	9.99e-05	4.31e-06	-29.4
Eutrophication Potential (kg Ne)	0	0.0213	3.37e-05	2.25e-06	-14.7
Ozone Depletion Potential (kg CFC11e)	0	3.04e-07	2.99e-10	1.11e-11	-2.98e-05
Smog Formation Potential (kg O3e)	0	1.98	0.00294	7.03e-05	-254
IPCC 2021					
Global Warming Potential (GWP 100), IPCC 2013 (kg CO2e)	0	19.4	0.0163	0.000581	-3.84e+03

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.

Table 13. *Resource use and waste flows per metric ton of Anodized Aluminum Extrusion fabricated by Keymark Corporation Fonda in Keymark Corporation Fonda]and percent contribution for life cycle stages A1 – A3. Results reported in MJ are calculated using lower heating values. All values arerounded to three significant digits.*

Parameter	Life Cycle Stage			
	A1	A2	A3	Total(A1-A3)
Resources				
Non-renewable primary resources used as an energy carrier (fuel) (MJ)	31600.0	747.0	62300.0	94600.0
Non-renewable primary resources with energy content used as material (MJ)	3660.0	0.0	11100.0	14800.0
Non-renewable secondary fuels (MJ)	0.0	0.0	0.0	0.0
Recovered energy (MJ)	23.2	0.163	153.0	176.0
Renewable primary resources used as energy carrier (MJ)	7930.0	9.76	3990.0	11900.0
Renewable primary resources with energy content used as material (MJ)	0.0	0.0	495.0	495.0
Renewable secondary fuels (MJ)	0.114	0.00424	1.18	1.3
Secondary materials (kg)	21.6	0.335	18.8	40.8
Use of net freshwater resources (m3)	31.1	0.0982	16.6	47.8
Wastes				
Components for re-use (kg)	0.0	0.0	0.0	0.0
Hazardous waste disposed (kg)	186.0	1.3	184.0	371.0
High-level radioactive wastem conditioned, to final repository (kg)	0.0101	4.45e-05	0.0651	0.0752
Intermediate and low-level radioactive waste, conditioned, to final repository (kg)	0.0209	0.000105	0.101	0.122
Materials for energy recovery (kg)	1.82	4.79e-05	0.00165	1.83
Materials for recycling (kg)	34.7	0.00638	1.91	36.6
Non-hazardous waste disposed (kg)	3040.0	24.4	1620.0	4690.0
Recovered energy exported from product system (MJ)	23.2	0.163	153.0	176.0

Table 14. *Resource use and waste flows per metric ton of Anodized Aluminum Extrusion fabricated by Keymark Corporation Fonda in Keymark Corporation Fonda and percent contribution for life cycle stages C1 – C4 and D. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Parameter	Life Cycle Stage				
	C1	C2	C3	C4	D
Resources					
Non-renewable primary resources used as an energy carrier (fuel) (MJ)	0.0	274.0	0.251	0.00978	-38200.0
Non-renewable primary resources with energy content used as material (MJ)	0.0	0.0	0.0	0.0	0.0
Non-renewable secondary fuels (MJ)	0.0	0.0	0.0	0.0	0.0
Recovered energy (MJ)	0.0	0.0601	0.361	5.34e-05	-2.32
Renewable primary resources used as energy carrier (MJ)	0.0	3.59	0.00411	0.00029	-17400.0
Renewable primary resources with energy content used as material (MJ)	0.0	0.0	0.0	0.0	0.0
Renewable secondary fuels (MJ)	0.0	0.00157	4.31e-06	5.38e-08	-0.0805
Secondary materials (kg)	0.0	0.123	0.00237	3.88e-06	384.0
Use of net freshwater resources (m3)	0.0	0.0362	0.000128	-8.66e-05	-77.7
Wastes					
Components for re-use (kg)	0.0	0.0	0.0	0.0	0.0
Hazardous waste disposed (kg)	0.0	0.478	0.00088	7.39e-05	-1200.0
High-level radioactive wastem conditioned, to final repository (kg)	0.0	1.64e-05	1.7e-08	1.5e-09	-0.00718
Intermediate and low-level radioactive waste, conditioned, to final repository (kg)	0.0	3.86e-05	4.1e-08	3.76e-09	-0.0211
Materials for energy recovery (kg)	0.0	1.77e-05	1.71e-08	7.08e-10	-0.000319
Materials for recycling (kg)	0.0	0.00202	0.133	1.64e-07	-1.47
Non-hazardous waste disposed (kg)	0.0	8.97	0.841	0.124	-5820.0
Recovered energy exported from product system (MJ)	0.0	0.0601	0.361	5.34e-05	-2.32

The PCR requires the calculation of carbon emissions and removals, all of which are negligible because no biogenic carbon is included in the product. Although installation of the product is not included in the life cycle of the Anodized Aluminum Extrusion, the ISO 21930 standard requires the reporting of the mass of packaging waste by type as well as the biogenic carbon contained in the packaging.

Table 15. *Packaging disposal and biogenic carbon content in packaging.*

Name	Unit	Value
Mass of packaging waste specified by type	kg	37.0
incineration	kg	1.06
landfill	kg	28.9
recycling	kg	7.03
Biogenic carbon contained in packaging	kg CO_2	62.6

6. LCA: Interpretation

The contributions to global warming potential results are primarily shared by A1 and A3, whereas the least impactful stages is A2.

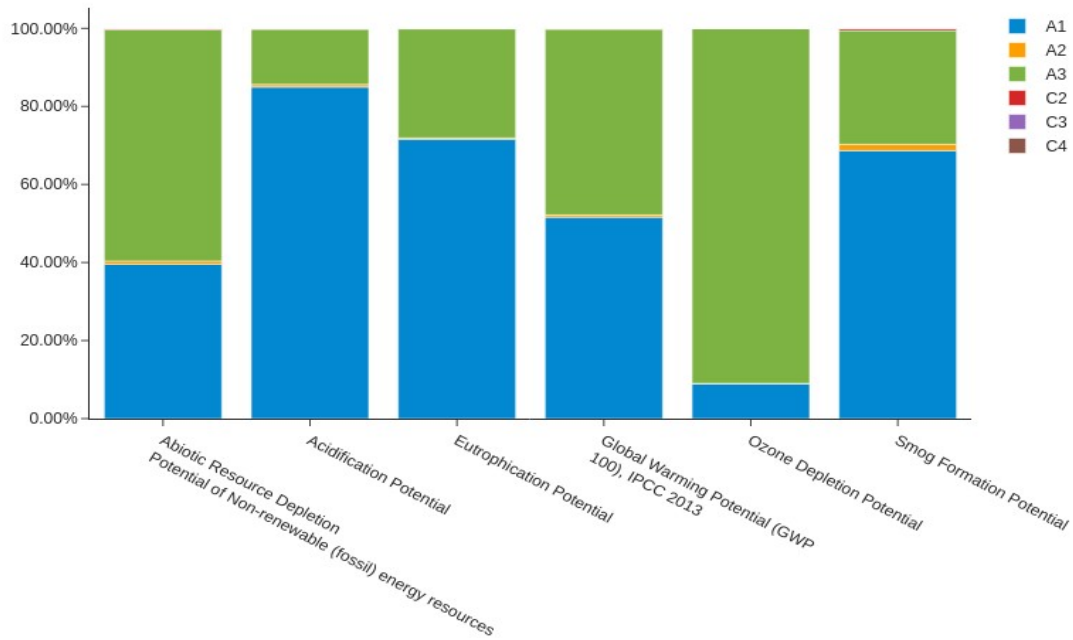


Figure 2. *Contribution analysis of module contributions to the cradle to gate Anodized Aluminum Extrusion impacts at the Keymark Corporation Fonda facility fabrication shop, assessed using TRACI 2.1*

Limitations

It should be noted that the indicators prescribed by the PCR do not represent all categories of potential environmental and human health impact associated with the life cycle of product, and this represents a general limitation of the LCA study.

Primary data of material components, upstream raw materials extraction and processing were not available and were modeled using representative data from Ecoinvent 3.10 LCI database.

7. Additional Environmental Information

7.1 ENVIRONMENT AND HEALTH DURING MANUFACTURING

There are no known measures relating to environmental and health protection during the product manufacture process that extend beyond national guidelines.

7.2 ENVIRONMENT AND HEALTH DURING INSTALLATION

There are no known measures relating to environmental and health protection during the product installation process that extend beyond national guidelines.

7.3 FURTHER INFORMATION

Further information for product or company information, as well as any environmental activities or programs, can be found on the manufacturers’ website at https://www.keymarkcorp.com.

8. References

• AEC EPD and PCF Generator Tool Methodology Report, SCS Global Services, March 2025

• AEC EPD and PCF Generator Tool, developed by SCS Global Services, March 2025

• AEC EPD and PCF Generator EPD Report Template, developed by SCS Global Services, March 2025

• ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.

• ISO 14040: 2006/AMD1 2020 Environmental Management – Life cycle assessment – Principles and Framework

• ISO 14044: 2006/AMD 1:2017/ AMD 2:2020 Environmental Management – Life cycle assessment – Requirements and Guidelines

• ISO 21930: 2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services

• AEC EPD and PCF Generator LCA Report Template, developed by SCS Global Services, March 2025

• PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 4.0. UL Environment. March 2022

• PCR Guidance for Building Related Products and Services Part B: Aluminum Construction Product EPD Requirements. UL Environment February 2022

• SCS Type III Environmental Declaration Program: Program Operator Manual. V12.0 December 2023. SCS Global Services

9. Annex – Sensitivity Analysis

This annex explores alternative results based on co-product allocation method under the perspective that the recycling of pre-consumer manufacturing scrap is typical practice and should not be considered 'recycling'. From this point of view, the aluminum scrap manufacturing waste generated at the Keymark Corporation Fonda's facility(ies) is treated as a co-product with all electricity and resources used at the manufacturing facilities attributed to the extruded aluminum and scrap on a mass basis. At the cast house, this scrap is treated as primary aluminum in the model.

The alternative allocation method is shown in Figure 3, and is termed Co Product Method for purposes of this report. This Co Product Method considers the handling and processing of scrap and its incorporation into Keymark Corporation Fonda's supply chain. Energy and resources (water and ancillary) are allocated to the extruded aluminum products and scrap generated based on the mass. The recycling process and transportation of the material is allocated to this analysis. Table 16 shows the primary and secondary material composition considered for the co-product allocation at each step.
A comparison of results is shown in Table 17.

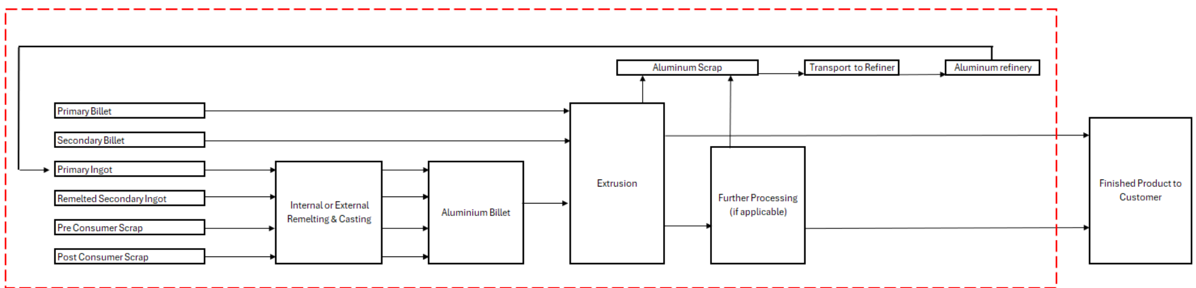


Figure 3: *Flow chart breakdown of using an allocation approach which assumes pre consumer recycled aluminum scrap includes the burden of upstream production. (Co Product Method)*

Table 16. *Primary and secondary material content*

Primary and secondary content		
Primary		50.2%
Secondary	Pre-Consumer	49.8%
	Post-Consumer	-0.0%

Table 17. *TRACI impact assessment method sensitivity results for Anodized Aluminum Extrusion at the Keymark Corporation Fonda facility(ies).*

Indicator	Unit	Recycled Content Method	Co Product Method	Percentage Difference
Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources	MJ	89000.0	66600.0	33.6%
Acidification Potential	kg SO2e	31.9	24.5	30.4%
Eutrophication Potential	kg Ne	20.0	16.9	18.7%
Global Warming Potential (GWP 100), IPCC 2013	kg CO2e	9350.0	6990.0	33.7%
Ozone Depletion Potential	kg CFC11e	0.000813	0.000522	55.8%
Smog Formation Potential	kg O3e	346.0	268.0	28.8%

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