Creative Aluminium Solutions
Aluminium Products Company (ALUPCO)

ENVIRONMENTAL FOOTPRINT INSTITUTE

Environmental Product Declaration

Under the general rules of the Environmental Footprint Institute.

Product Group Classification: UN CPC 42120

In accordance with ISO 14025 and EN 15804 for:

Aluminium profiles

Aluminium Products Company (ALUPCO)

Program:	The Environmental Footprint Institute www.environdec.com
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Geographical scope:	Global

INTRODUCTION

This report contains the environmental performance of the manufacturing process of aluminium profiles made from primary aluminium developed by Aluminum Products Company (ALUPCO) This Environmental Product Declaration (EPD) has been developed using the Life Cycle Assessment (LCA) methodology. The environmental impact values calculated are express referred to one kilogram of aluminium profile.

The assessed life cycle includes all phases in the manufacturing process of aluminum profiles "cradle to gate". The LCA covers from the production of all raw materials (aluminium billets, chemicals, etc.), extrusion, coating or anodizing, and all others manufacturing processes up to the distribution to final customers.

Al profiles by ALUPCO can be sold "as is", powder coated, or anodized with different colors. This EPD covers all three product groups.

This EPD has been conducted according to the Environmental Footprint Institute regulations and certified and registered in The Environmental Footprint Institute. The EPD regulation is a system for the international use of Type III Environmental Declarations, according to ISO 14025:2010. Not only the system, but also its applications are described in the Programmer's General Indications (PGI). This report has been made following the specifications given in the European standard EN 15804:2012+A2:2019.

The direct and indirect emissions and the corresponding environmental impacts calculated in the life cycle assessment and reported in this EPD include the calculation of the carbon footprint value, the water footprint and other environmental impacts to air, land and water.

This EPD represents a complete and objective vision of the environmental performance of the manufacture process and distribution of aluminium profiles by ALUPCO.

GENERAL INFORMATION

ALUPCO - Aluminium Products Company

ALUPCO
Aluminium Products Company

38 St, Industrial Area No 1,
Dammam 32234,
Saudi Arabia

Aluminium Products Company (ALUPCO) is the Market leader and the largest producer of extruded and surface treated Aluminum profiles in the entire Middle East. ALUPCO is also renowned for its variety of surface treatment such as electrostatic powder coating, anodizing, polishing and wood finish coating.

ALUPCO Head Office and Dammam plant is located in 1st Industrial City (Eastern Province of Saudi Arabia), while ALUPCO other plant is located in Jeddah Industrial City – Phase II (Western Province) covering a total area of 135,000 square meters. ALUPCO also operates sale centre offices in Riyadh, Dubai, and Cairo to cater to the needs of all its customers based in Saudi Arabia, the Middle East, Africa, Europe, and the rest of the world.

ALUPCO sustainable practices

ALUPCO is the first aluminium extrusion company in the Middle East to be awarded with the prestigious ISO 9001 certificate in 1995 and ISO 2000 certificate in 2004.

To maintain the high quality standards of its products, European (EN), German (DIN), British (BS), American (ASTM) and the Saudi (SASO) standards are strictly followed in every step of its operations and thus ALUPCO has been approved and granted certificates of such quality standards.

Analysed product

The assessed system in this Environmental Product Declaration (EPD) comprises the full life cycle of **aluminium profiles by extrusion** with different surface treatment manufactured by ALUPCO in its plants in Dammam and Jeddah, Saudi Arabia. This assessment has been done using the production data of year 2019 in ALUPCOS`s plant in Dammam.

Types of coating systems

ALUPCO manufactures and sells:

1. Aluminium profiles "as is".
2. Electrostatic powder coated.
3. Anodized and polishing with different colour finishes.

All profiles are firstly subjected to chemical surface pretreatment and coated with electrostatic powder paints or anodized and polished. Wood transfer can also be applied over profiles for a wood finish coating.

Declared Unit

This EPD presents the environmental impact of coated and anodized aluminium profiles manufactured by ALUPCO.

ALUPCO produces and distributes aluminium profiles in various finishes and formats. To standardise the results of this environmental study the **Functional Unit** of the LCA is **one kilogram (1 kg) of aluminium profile.** All direct and indirect environmental impacts, as well as the use of resources, are reported referred to this unit.

This EPD presents the impacts separately for the two versions of aluminium profiles:

- Coated aluminium profiles manufactured by ALUPCO
- Anodized aluminium profiles manufactured by ALUPCO

System boundaries

This EPD covers all product stages from "cradle to gate", this means that process in the life cycle from raw materials manufacturing to transport to final customers are included. Final disposal is not included in this LCA but the aluminium recycling potential is described in the EPD.

ALUPCO buys to external suppliers the aluminium billets, from this point ALUPCO

controls all the manufacturing process: extrusion, coating, anodizing, etc. ALUPCO only uses primary aluminium, they do not use aluminium scrap.

The only procedures that are not controlled by the company but are included in this environmental study are: the manufacturing process of the aluminium billets; the manufacture of chemicals and raw materials use in coating and anodizing of profiles (these procedures can be considered "upstream" in this LCA); the extraction and production of fuels, the production of electricity; the production of the machinery, buildings and vehicles. All related direct and indirect environmental impacts related to these elements have been calculated and are reported in this EPD. Following the LCA methodology, the indirect environmental impacts related to the machinery and buildings construction have been amortized over the life period of the hardware.

The scope of this EPD is "cradle to gate with options".

Possible scopes of the LCA defined in PCR 2019:14 Construction products and the European standard EN 15804:2012+A2:2019:

Product stage			**Construction process stage**		Use stage						End of life stage					Resource Recovery Stage
Raw materials	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse Recovery Recycling potential
A1	**A2**	**A3**	**A4**	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	**X**	**X**	**X**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

X = Included, ND=Module not declared, NR= Module not relevant

Modules from A5 to D are not included (X refers to considered stage, NR refers to not relevant stage and ND to not declared stage).

Upstream Processes (A1: Raw Material Supply): Production for each product starts with mainly locally sourced but some transported from other parts of the world. 'Raw material supply' includes raw material extraction and pre-treatment processes before production including foundry of billets by melting down raw aluminium blocks.

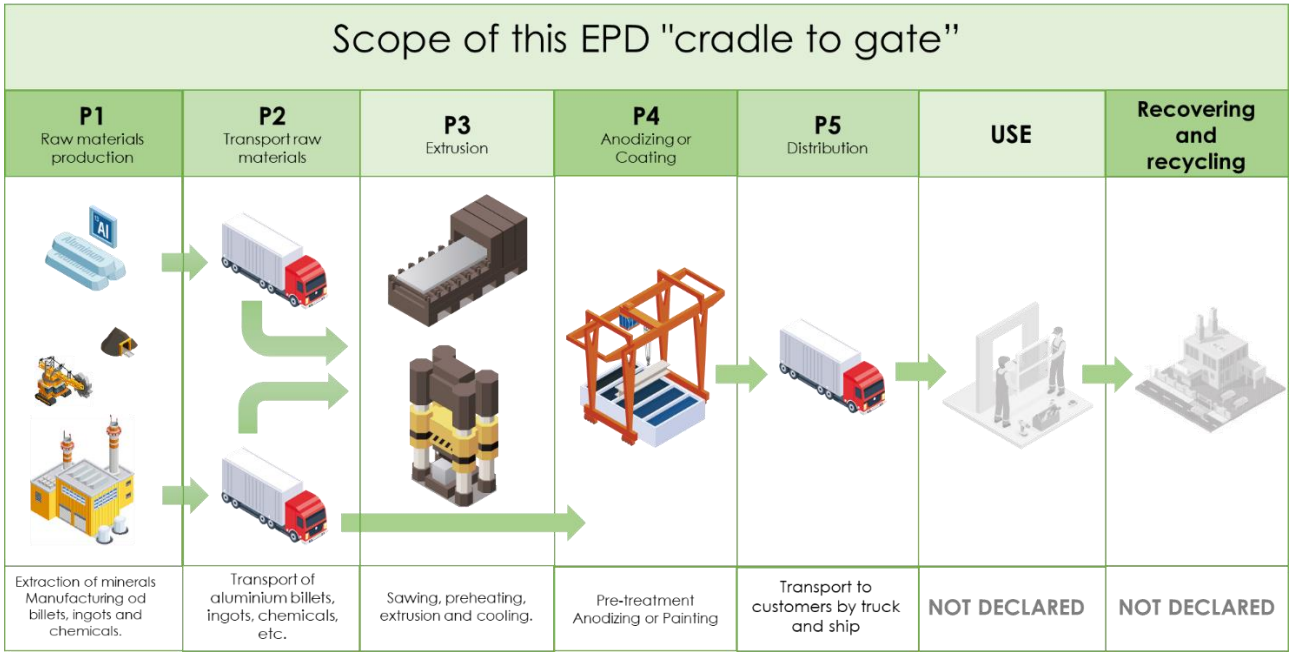
Core Processes (A2: Transportation, A3: Manufacturing and A4: Distribution): Transport is relevant for delivery of raw materials to the plant (billets and aluminium ingots, chemicals etc.) and the transport of materials within the plant. Aluminium profile production starts with

extrusion, cooling and cutting for the desired length. Electricity and natural gas are consumed at aluminium profile production proses. Extruded profiles go into powder coating or anodising processes according to the customer demand.

Product Stages

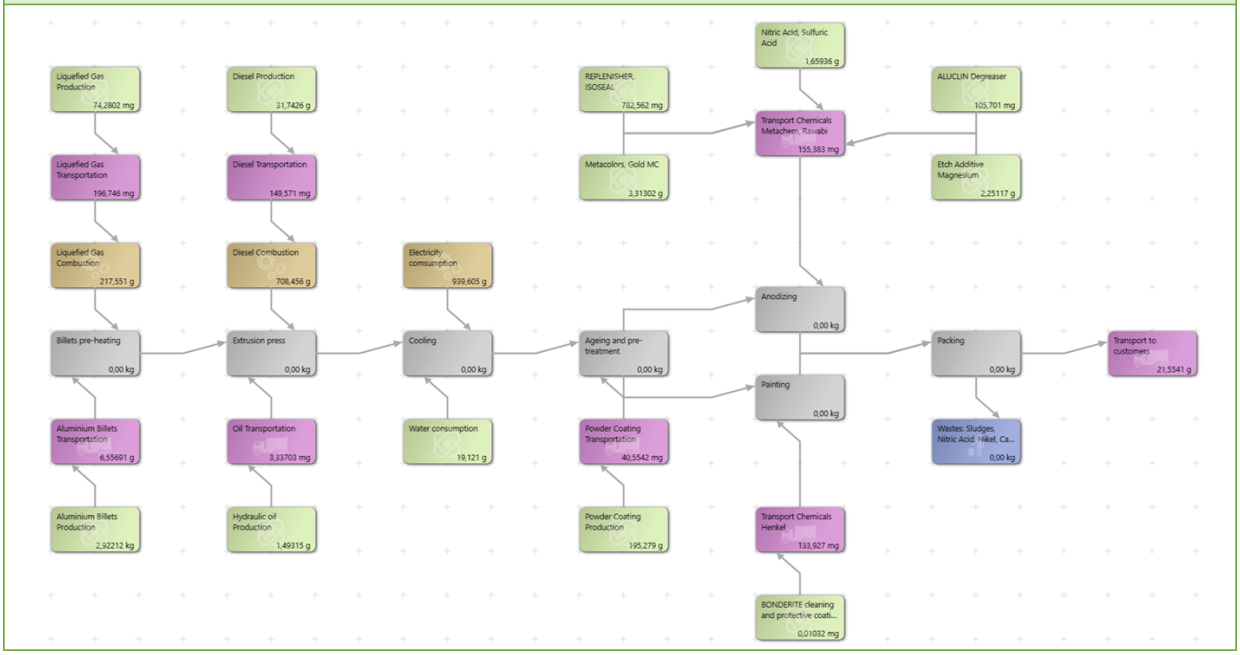
A simplified model of the manufacturing and distribution process is described in the following diagrams, enumerating the main activities included in the system boundaries. The process and facilities are also linked to the phases of the product life cycle (P1-P4).

The first phase in the LCA is the production of aluminium billets and ingots (P1). ALUPCO buys the aluminium billets, ingots, and the powder coating to different suppliers in Saudi Arabia (P2). After the extrusion process and powder coating (P3) there are two different types of profile finishes: coating and anodizing (P4). The aluminium profiles are distributed to customers around the word (P5). In this EPD environmental impacts are reported by phase and type of profile finishes.



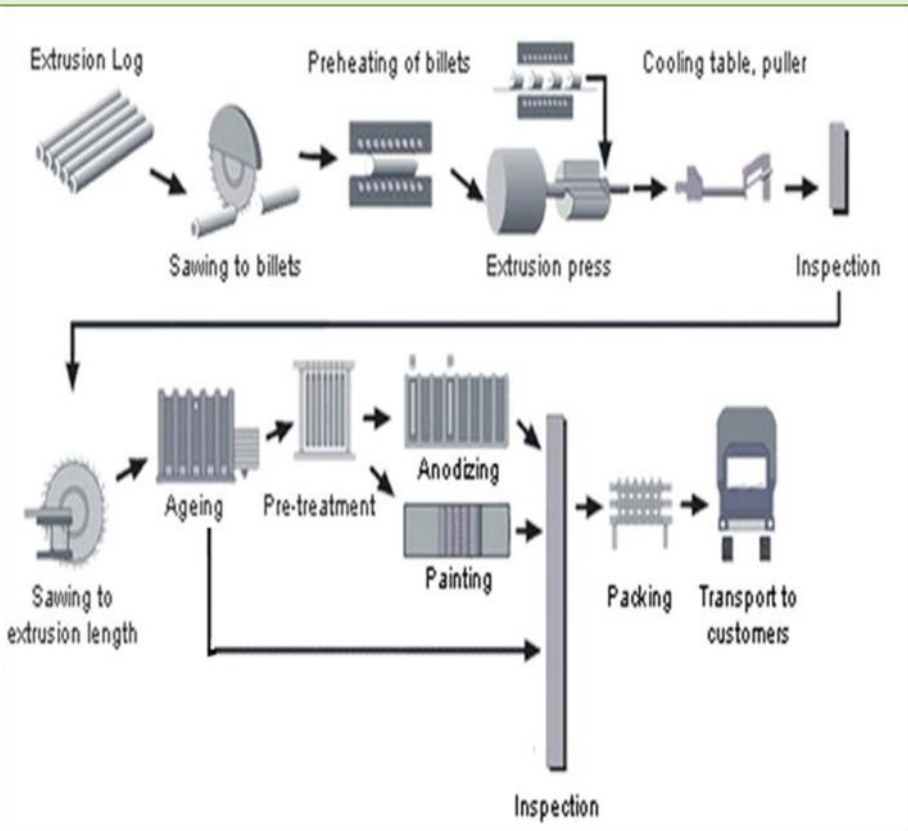
The following diagrams, designed for this EPD using Air.e LCA software, show the materials, fuels consumption, energy consumption transports and other procedures included in the assessment.

Elements in the Life Cycle Assessment



The following diagram is a more detailed description of the P3-P4 phases.

Manufacturing process



Content declaration

The following list shows the main materials used in the manufacture of aluminium profiles by ALUPCO in the analysed life cycle.

Material	Coated Aluminium Profiles	Anodized Aluminium Profiles
Aluminium	94%	97%
Silicon	0,5 – 1%	0,5 – 1%
Magnesium	0,5 – 1%	0,5 – 1%
Powder coating	< 1%	< 1%
Anodising Agents and Chemicals	-	< 1%
Polyester	4%	-

Substances listen in the "Candidate List of SVHC"

The aluminium profiles do not contain substances which exceed the limits for registration with the European Chemicals Agency regarding the "Candidate List of Substances of Very High Concern for authorisation".

TECHNICAL INFORMATION

Calculation methodology

This EPD represents a Type III Environmental Declarations according to ISO 14025 2010. The Life Cycle Assessment (LCA) has been developed following the ISO 14040 International Standard. The environmental impacts calculation method reported in this EPD follow the ILCD methodology rev 2.0 developed by the European Commission in April 2018. The report has been done following the specifications given in the European standard EN 15804:2012+A2:2019, as Product Category Rules.

Emissions Factors

Emission factors and environmental impacts of elements in the life cycles that are not directly controlled by ALUPCO (aluminium billets production, chemicals, electricity, fuels production, etc.) have been analysed using external studies and external emissions factors databases like Ecoinvent due to the lack of direct data. The next paragraphs describe the calculation rules and criterial applied in the calculation of the environmental performance of this type of elements in the LCA.

Aluminium and chemicals

A generic dataset from Environdec 3.6 database with the emission factors associated to aluminium billets production have been characterized by solid Forest in this LCA to adjust it to the characteristics of the aluminium production conditions in countries where ALUPCO suppliers are located (United Arab Emirates and Saudi Arabia).

Emission factor from default datasets in Environdec 3.6 database associated to chemical components used for coating, anodizing and aluminium billets pre-treatment have been characterized by Solid Forest to adjust them to the characteristics of the products manufactures by ALUPCO`s suppliers.

Electricity

A specific dataset with the Life Cycle Inventory (LCI) corresponding to the electricity mix in Saudi Arabia in 2019 has been developed by Solid Forest for this LCA. The electricity mix reported by Saudi Electricity Company in 2019 was 60% natural gas, 35% petroleum and 5% renewable energies. The emission factor for medium electricity consumption in Saudi Arabia in 2019 was 0,95 Kg CO_2e/KWh of GWP 100a.

Fuels production and consumption

Specific datasets with the emissions factors corresponding to the diesel and liquefied natural gas combustion in ALUPCO plant furnaces and machinery has been developed for this LCA. The indirect emissions due to diesel and natural liquefied gas production and transportation are included in the environmental impact values reported in this EPD. In the calculation a liquified gas natural density of 0,43 kg/l and a diesel density of 0,85 kg/l. In the calculation a liquified gas natural calorific value of 47 MJ/kg and a diesel calorific value of 43 kg/l.

Transports

The transport means in phases P2 and P5 are trucks EURO 6 with a capacity of >32t and international cargo ships. The aluminium profiles where provided by APULCO in 2019 to customers all over the world. To create a scenario of the P5 phase, all aluminium profiles manufactured during the whole year has been analysed as representative of the international transport distribution calculating an average of transported tone*km / total distance

Calculation rules

Version 3.8 of software Air.e LCA™ with Ecoinvent™ 3.6 database have been used for LCA modelling and impacts calculations.

Annual Statistics 2019 report from Saudi Electricity Company have been used to create the model of electricity mix in Saudi Arabia.

Minor components not directly related to the product, with less than 1% impact, such as office supplies, have been excluded from the assessment.

All transports of components have been included in the LCA considering real distances travelled by materials used from January 2019 to December 2019. Transport of raw materials needed to manufacture components are estimated in a global scale according to Ecoinvent™ criteria. Main means of transport have been included for materials purchases and feed ingredients. As exact crops locations are not known in detail, transport distances have been calculated from a general position in the country of origin to the feed factory. Operation in port has also been excluded.

Road distances calculated using Google Maps. Maritime distances calculated using MarineTraffic Voyage Planner.

Cut-off rules: more than 99% of the materials and energy consumption have been included.

The Polluter Payer Principle and the Modularity Principle had been followed.

By-products assignment

There are no by-products in this LCA so there was no need to apply allocation rules.

ENVIRONMENTAL PERFORMANCE

Potential Environmental Impacts

In the following tables, the environmental performance of the declared unit "one kilogram of aluminium profile" is presented for anodized and coated finishing, totalized and for every sub-phase of the life cycle.

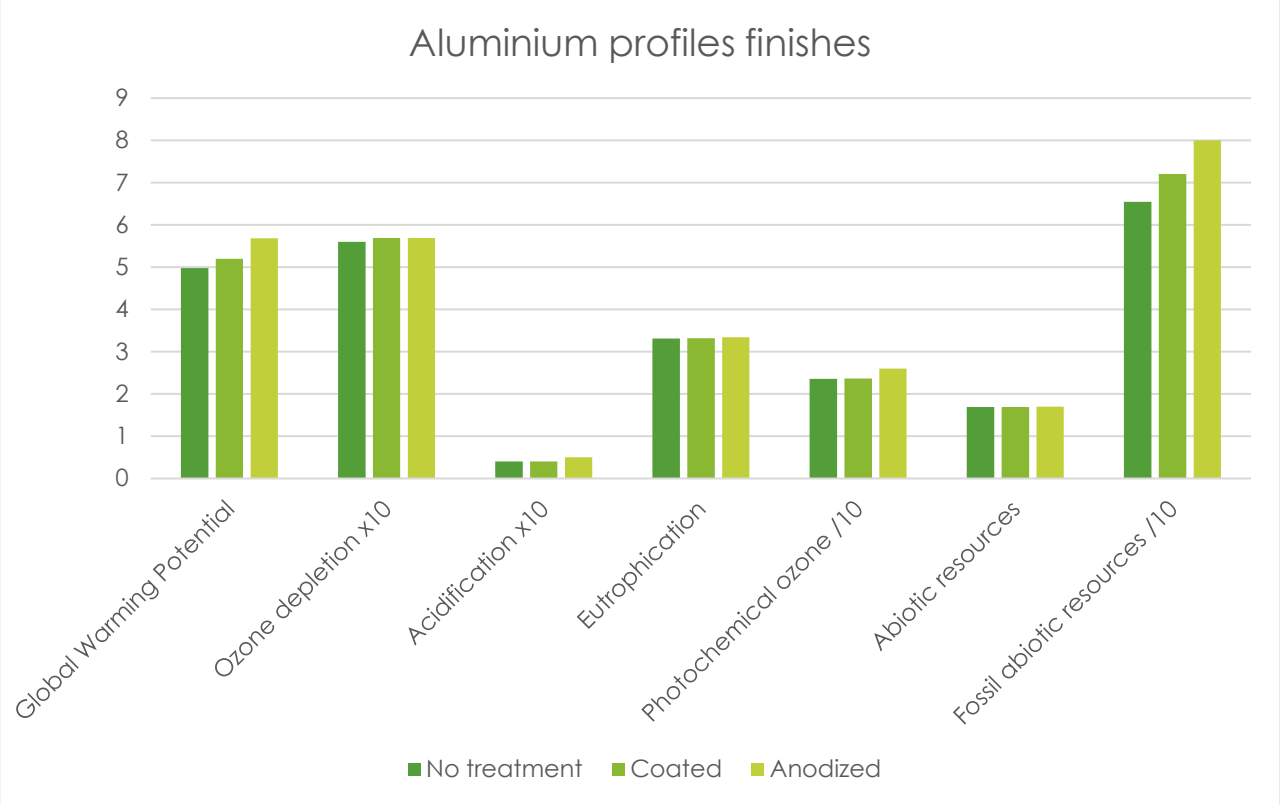
In all impact categories anodized profiles have greater values than coated profiles. This is because the anodizing process is intensive in the use of natural gas, electricity and chemical substances used in the surface treatment. The ozone depletion associated to the anodizing stage is greater than the one associated to the billet production, the same happens with the abiotic resources depletion, both elements and fuels.

All environmental impacts are calculated using the Environmental Footprint (ILCD) version 3.0 methodology from the European Commission.

Anodized aluminium profiles	P1 Materials production	P1-P3 Materials Supply and extrusion	P4 Anodizing	P5 Distribution	Total
Global Warming Potential (GWP100) (kg of CO_2 equivalent)	3.15	1.81	0.70	0.02	**5.68**
Ozone depletion (mg of CFC11 equivalent)	0.32	0.23	0.09	0.01	**0.65**
Acidification of land and water (mol H+ equivalent)	0.03	0.01	0.00	0.00	**0.04**
Eutrophication (g of PO_4^{3-} equivalent)	3.12	0.20	0.03	0.00	**3.34**
Photochemical ozone creation (g of C_2H_4 equivalent)	15.72	7.75	2.43	0,07	**25.34**
Depletion of abiotic resources (elements) (mg of Sb equivalent)	1,686.51	6.69	20.00	4.00	**1,693.44**
Depletion of abiotic resources (fuels and fossil) MJ net calorific value	46,59	22.65	10.39	0.35	**79.98**

Coated aluminium profiles	P1 Materials production	P1-P3 Materials Supply and extrusion	P4 Coating	P5 Distribution	Total
Global Warming Potential (GWP100) (kg of CO_2 equivalent)	3.11	1.80	0,22	0.02	**5,15**
Ozone depletion (mg of CFC11 equivalent)	0.25	0.23	0,09	0.01	**0.58**
Acidification of land and water (mol H+ equivalent)	0.03	0.01	0,01	0.00	**0.05**
Eutrophication (g of PO_4^{3-} equivalent)	3.12	0.20	0.01	0.00	**3.33**
Photochemical ozone creation (g of C_2H_4 equivalent)	15.48	7.75	0,66	0,07	**23.96**
Depletion of abiotic resources (elements) (mg of Sb equivalent)	1,686.51	6.69	0.04	0.04	**1,693.27**
Depletion of abiotic resources (fossil) MJ net calorific value	42,48	22.65	6.56	0.35	**72.04**

In the graphic bellow environmental impacts values have been normalized.



Energy resources

It was not possible to distinguish the consumption of electricity and natural gas between the production stages of profiles. The direct and indirect total emissions of CO_2e due to total electricity consumption are 1,88 kg CO_2e per kilogram of aluminium profile. The direct and indirect total emissions of CO_2e due to total diesel and liquified gas consumption are 0,92 kg CO_2e per kilogram of aluminium profile.

	A1-A3 **Anodized aluminium profiles**	A1-A3 **Coated aluminium profiles**
Use of RENEWABLE primary energy excluding renewable primary energy resources used as raw materials	0.02	0,01
Use of RENEWABLE primary energy resources used as raw materials	<0,01	<0,01
Total use of RENEWABLE primary energy resources (primary energy and primary energy resources used as raw materials)	0.02	0,01

Data in MJ, net calorific value

	A1-A3 **Anodized aluminium profiles**	A1-A3 **Coated aluminium profiles**

Use of NON- RENEWABLE primary energy excluding non-renewable primary energy resources used as raw materials	84.40	73.1
Use of NON-RENEWABLE primary energy resources used as raw materials	<0,01	<0,01
Total use of NON-RENEWABLE primary energy resources (primary energy and primary energy resources used as raw materials)	84.40	73.1

Data in MJ, net calorific value

Use of resources

The following resources use assessment refers to the production phases (A1-A3) and do not include the distribution phase (A4).

Scrap aluminium is not used in the production of aluminum profiles in Alupco.

	A1-A3 **All types of aluminium profiles**	Description
Use of secondary material	<0,01	Use of aluminium scrap.

Data in kg

	A1-A3 **All types of aluminium profiles**	Description
Use of net fresh water	32.80	Direct and indirect use of water

Data in m3

	A1-A3 **All types of aluminium profiles**	Description
Use of RENEWABLE secondary fuels	<0,01	No renewable fuels used.
Use of NON-RENEWABLE secondary fuels	3.67	Diesel consumption (net calorific value 10.18 KWh/l)

Data in MJ, net calorific value

Waste disposed

The waste disposal assessment refers to the production phases (A1-A3), distribution phase (A4) is not included.

	A1-A4 **All types of aluminium profiles**	Description
Hazardous waste disposed	649.35	Dried dewatered sludge
Non-hazardous waste disposed	324.67	Black Mud and Zinc ash waste
Radioactive waste disposed	<0.01	No nuclear energy used

Data in kg

Other output flows

The following output flows assessment refers to the production phases (A1-A3), distribution phase (A4) is not included.

	A1-A4 **All types of aluminium profiles**	Description
Components for re-use (Kg)	0	0
Materials for recycling (Kg)	0.90	Aluminium for recycling from 1 kg of aluminium profile
Materials for energy recovery (MJ)	0	0
Exported energy (MJ)	0	0

Recycling and disposal

Aluminium products are highly recyclable. During aluminium profile production, all post-industrial scrap (extrusion drop-offs from cutting, unfit material and discards, etc.) is fed back into the billet production process.

The presence of plastic components in the profiles reduces the useful amount of aluminium to be recycled at the end of life and it supposes a greater problem in the landfill.

When an aluminium building product reaches the end of its life, it is systematically and electively collected and sent to recycling facilities for secondary billet production. A collection rate for aluminium products next to 95% is well documented in construction sector.

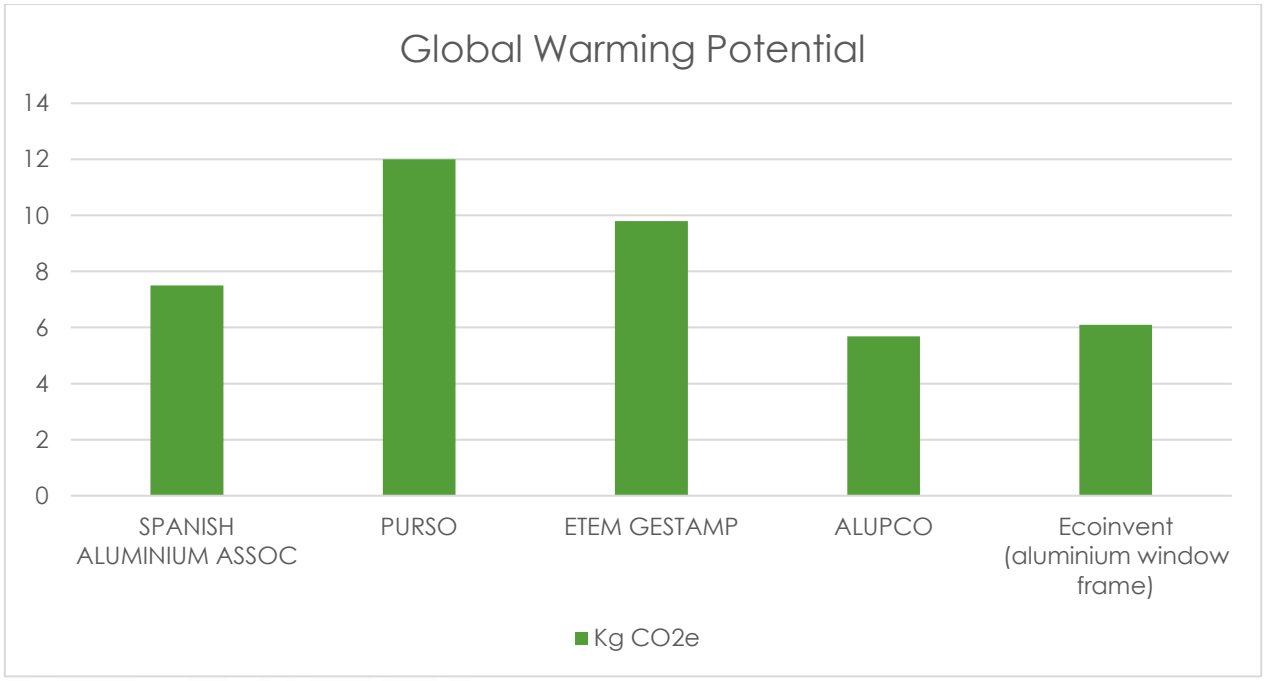
BENCHMARKING

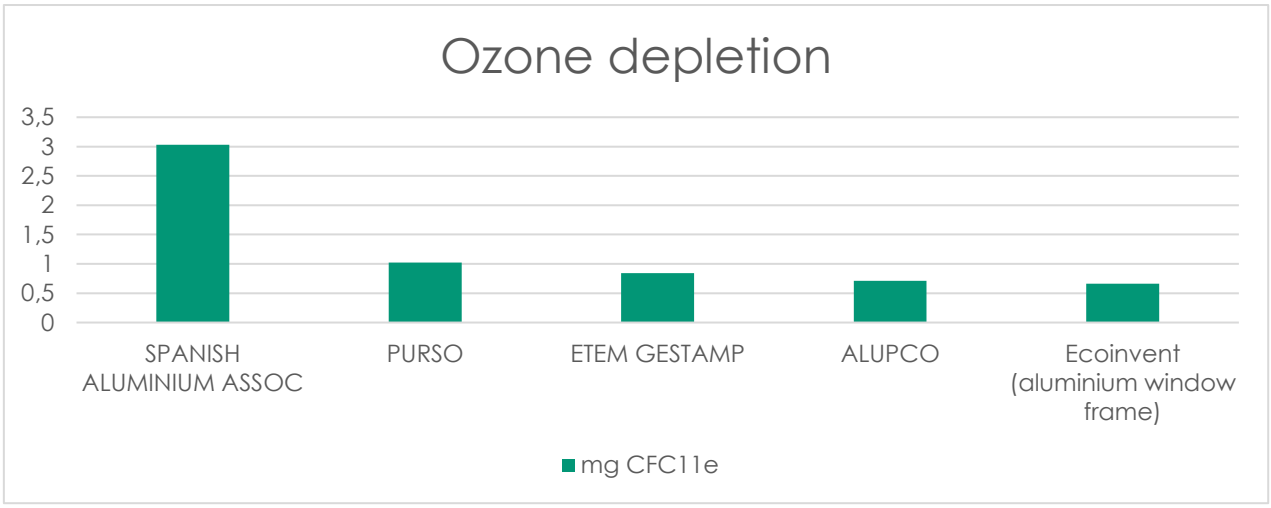
EPD results should not be compared between each other, even if products analysed in the EPDs are supposed to be similar. There are too many variables in the study to be considered to be sure the comparation is objective. The scope of the assessments and the elements included in the life cycles can be different, and even the emission factors and calculation methodologies used can differ.

Nevertheless, we can consider that ALUPCO aluminium profiles have a better environmental performance than most aluminium profiles manufacturers, mainly due to the sort distances to final customers and suppliers. All manufacture processes in ALUPCO are optimized and energy consumption is very low.

The following benchmarking assessment has to be considered as a subjective study that can give a general idea of the environmental performance of ALUPCO aluminium profiles compare with other environmental studies.

The international emission factors database Ecoinvent includes two datasets related to the aluminium profiles production in ALUPCO: "anodising, aluminium sheet" and "powder coating, aluminium sheet". Besides, he International EPD® System has five EPD registers for this kind of product: "Aluminium profiles by SARAY", "Aluminium profiles by Etem Gestamp", "Aluminium profiles made form primary aluminium by Purso Oy", "Aluminium window profiles by Fresia Alluminio" and "Anodized and coated aluminium profiles bu Asociación Española de Aluminio y Tratamientos de Superficie".




Ozone depletion
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Ecoinvent (aluminium window frame)
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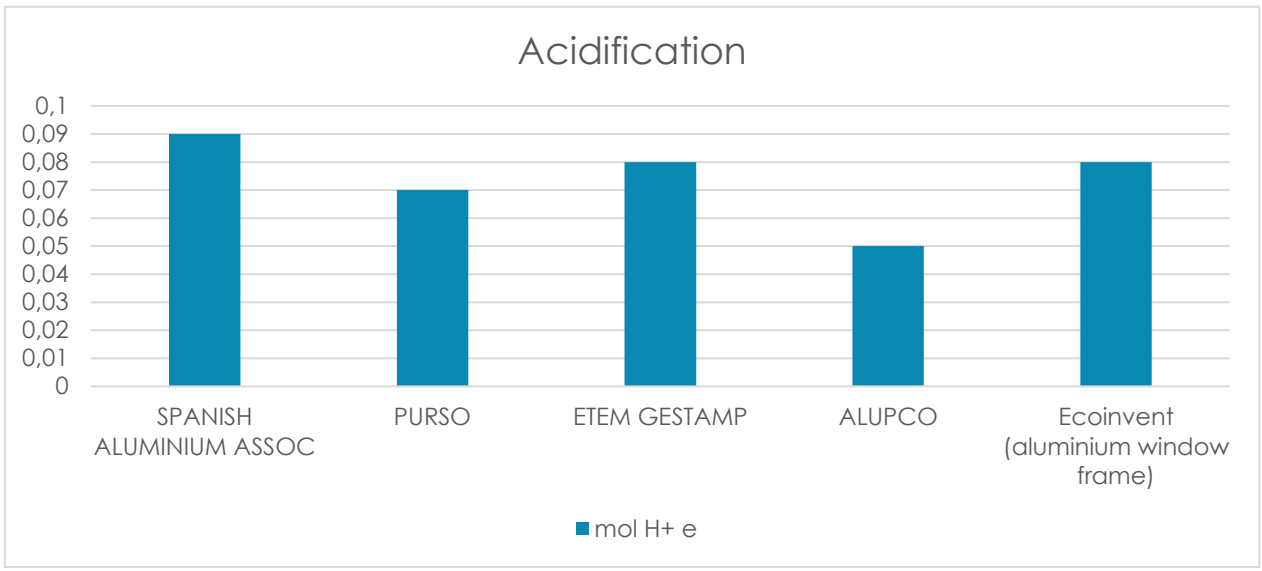
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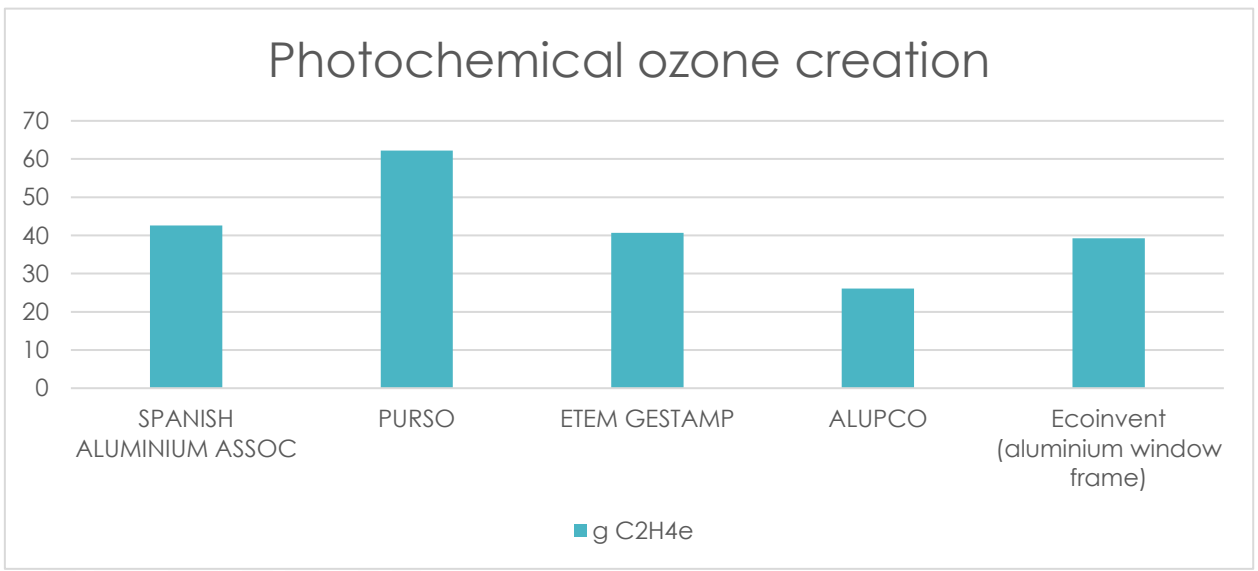
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IMPROVEMENT PROPOSALS

After developing this EPD and analysis the life cycle of the products, there are some general tips that ALUPCO could follow to improve the environmental performance of their aluminium profile's production process:

1. ALUPCO could contract an electricity supplier that uses renewable energy technologies or with a better electric mix. This would reduce the indirect emissions due to electricity consumption in the profiles production and anodizing.

2. Encourage suppliers to renovate their fleet, maintain and renovate the truck fleet to be sure all vehicles have and EURO 6 engine or, wherever it is possible, use electric vehicles would reduce the emission of Green House Gases and particles to the air responsible of: global warming, photochemical ozone creation and health problems.

3. Aluminium has a very high recyclability potential, ALUPCO could encourage customers to recycle the aluminium profiles after their end of life.

4. The use of billets with a high percentage of recycled aluminium from scrap will reduce the energy consumption in the manufacturing process of the billets up to a 90%.

5. Resell or reuse the sodium aluminate, residue of cleaning process of the matrices, to a company that can use it as a raw material.

6. Use 100% TGIC free paints in the coating process of the aluminium profiles.

7. Use 100% free chrome hexavalent products in the coating process of the aluminium profiles.

8. Highly to customers the energy saving potential of aluminium windows in the isolation of houses and building. This means a high reduction of the energy consumption in homes and offices.

9. The implementation of an environmental management system certified under the international normative ISO 14000 would help ALUPCO to control all the environmental parameters in the company including the production process of the aluminium profiles.

INFORMATION AND VERIFICATION

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PCR review was conducted by: The Environmental Footprint Institute. Chair: Iván Jiménez. Contact: info@huellaambiental.org
Independent verification of the declaration and data, according to ISO 14025:2006 and ISO 14040: ☐ EPD Process Certification (internal) **X** EPD Verification (external)
Third party verifier: Alfredo Costalago Alcántara Accredited by: The Environmental Footprint Institute

MANDATORY STATEMENTS

Explanatory material can be obtained from EPD owner and/or LCA author. Contact information can be found below.

The verifier and The Environmental Footprint Institute do not make any claim or present any responsibility about the legality of the product.

EPDs within the same product category but from different programmes may not be comparable.

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Programme operator:	The Environmental Footprint Institute Calle Circe 49A Madrid, Spain www.environmentalfootprintinstitute.com info@ environmentalfootprintinstitute.com Alfredo Costalago Alcántara

REFERENCES

This Environmental Footprint has been developed and diffused following the instructions of the Environmental Footprint Institute. Further information and the document itself with reference XXXXXXX are available at: www.environmentalfootprintinstitute.org

LCA Report: Life Cycle Inventory of Aluminium profiles by Aluminun Products Company

Software: Air.e LCA rev. 3.6 www.solidforest.com

Main database: Ecoinvent 3.5 www.ecoinvent.org

Geographical scope of the EPD: Global.

Normative: ISO 14040:2006 "Environmental management -- life cycle assessment -- principles and framework"; ISO 14044:2006 "Environmental management -- life cycle assessment -- requirements and guidelines"; ISO 14020 "Environmental Labelling: General Principles"; ISO 14025:2006 "Environmental labels and declarations -- type III environmental declarations -- principles and procedures" and EN 15804.