ENVIRONMENTAL PRODUCT DECLARATION

EPD®
S-P-01409

GlobalEPD
A VERIFIED ENVIRONMENTAL DECLARATION
GlobalEPD-IntEPD S-P-01409

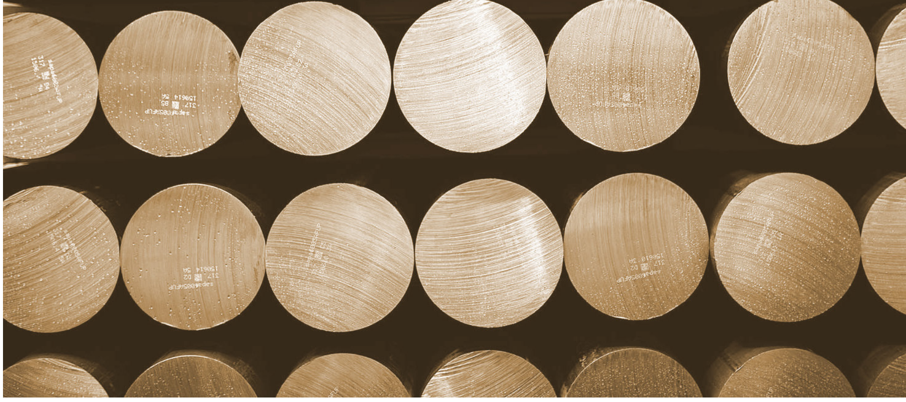
In accordance with ISO 14025 and EN15804+A1 for:

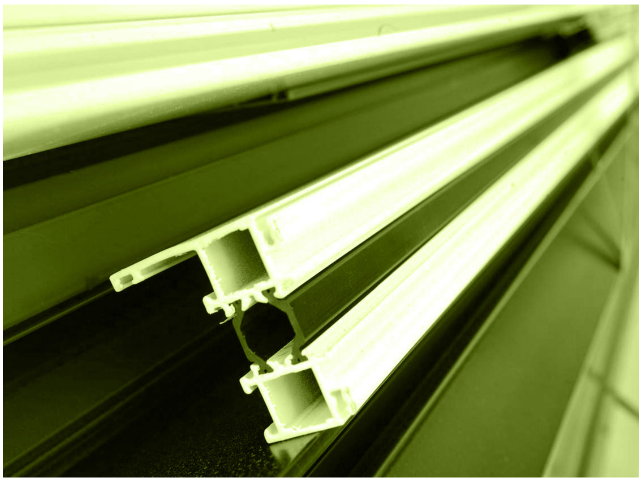
ANODIZED AND COATED ALUMINIUM PROFILES

AEA
Asociación Española del Aluminio y Tratamientos de Superficie

EPD Program	**The International EPD® System**
CPC Code	**41532 Bars, rods and profiles, of aluminium**
Based on	**PCR 2012:01 v2.2 Construction products and construction services. EPD System.**
Declaration number	**S-P-01409**
Approval date	**2018-10-19**
Publication date	**2018-10-31**
EPD expire on	**2023-10-19**
Market coverage	**Worldwide**
Representativeness	**Spain**

SUMMARY





ABOUT AEA

The Aluminium Spanish Association (Asociación Española de Aluminio – AEA) is a non-profit association that represents the Spanish aluminium industry and watches over the defense of its global interests.

The AEA is composed of 89 members, including extruders, lacquers and anodizers, as well as suppliers of quality services and raw materials such as primary and secondary aluminium, powder coating, thermal bridge break profiles (TBB) and chemical products for surface treatments.

The information in this document is based on data supplied by 12 AEA member companies who have produced a comprehensive industry-wide environmental product declaration (EPD) for anodized and coated aluminium profiles. The data comes from 17 separate production facilities, with a total of 38 extrusion presses, 13 anodizing lines, 20 coating lines and 1 cast house that produces secondary extrusion billet starting from post-industrial and consumer aluminium scrap. 3 of these 12 companies have own cast house to recycle the post-industrial aluminium scrap produced in their installations. Two manufacturers of polyamide profiles (TBB) and a manufacturer of chemical products (used in anodizing and coating) have also participated in the generation of the inventories. In aggregate, the data-contributing installations have a production capacity of more than 280.000 ton of aluminium profiles, about 74% of total AEA production and 62% of the total Spanish production.

PARTICIPATING COMPANIES

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PRODUCT

Product description

This EPD covers a wide range of aluminum extrusion products manufactured by AEA members in Spain, not conside-ring a burden for scrap or credit for the EoL (End of Life) . The products considered in this declaration are as follows:

- Anodized aluminium profile

- Coated aluminium profile

- Thermal break anodized aluminium profile

- Thermal break coated aluminium profile

It excludes downstream fabrication operations such as machining and assembly due to the wide diversity of such operations.

The results are an average representative of all aluminium profiles produced for AEA members. Averages are obtained through aggregating production-weighted data from the participating companies.

Applications

Aluminium profiles are primarily used in building and construction applications, including windows, doors, curtain walls, façade systems, skylights, canopies, etc.

Technical data

Technical data is representative of 6000 series aluminium alloys (6xxx alloy, tempers T1-T6), which is the predominant production of the participants.

Composition

Aluminium profiles can be produced as standard or customer design so there is a wide variety of profiles. Therefore, the composition of the final product can also be very different between designs. This EPD covers four product groups with an average composition as shown below. The product does not contain any substance included in the list of Substances of Very High Concern with concentrations higher than 0.1% in weight.

Packaging

Aluminium profiles are packaged using lumber, plastic film, plastic strapping and cardboard. Packaging is often per customer specification. All packaging materials are recyclable and/or reusable following delivery to the customer. Packaging materials are included in the scope of this EPD; packaging disposal and raw materials packaging, however, are outside the scope.

Property	Value	
Young's modulus	68 - 80 GPa	UNE-EN ISO 6892
Yield strength (elastic limit)	95 - 610 Mpa	UNE-EN ISO 6892
Tensile strength	180 - 620 Mpa	UNE-EN ISO 6892
Hardness - Vickers	60 - 160 HV	UNE-EN ISO 6507
Fatigue strength (10^7 cycles)	57 - 210 Mpa	UNE 7118
Density	2550 – 2900 kg/m^3	
Melting point	495 - 640 °C	
Thermal conductivity	118 - 174 W/m.°C	
Specific heat capacity	890 - 1020 J/kg.°C	

Reference service life and use phase

Service life for products will vary depending on the final application, but is typically long due to aluminium´s high corrosion resistance. It can accept a service life of 50 years according to bibliography. Similarly, further processing (other than anodizing, coating, or thermal improvement), assembly and/or installation of extruded aluminum products are outside the scope of this EPD.

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. Even some AEA members operate their own scrap smelting facilities in addition to purchasing billet from external secondary smelters or from primary aluminium manufacturer.

In the same way, when an aluminium building product reaches the end of its life, it is systematically and selectively 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.

In both cases recycling rate depends on smelting yield that includes metal losses during scrap preparation and melting. Smelting yield is highy influenced by the presence of non aluminium material (as TBB and/or coating) and the origin of the scrap (post-industrial or post-consumer).

Hence, aluminium supply at the beginning of the product system has a content of recycled material from post-industrial and post-consumer scrap with the consequent reduction of environmental burdens. In module D are

	ANODIZED PROFILE	COATED PROFILE	THERMAL BREAK ANODIZED PROFILE	THERMAL BREAK COATED PROFILE
Aluminium profile	**100%**	**~95,2%**	**~87,8%**	**~83%**
Aluminium	93-96%			
Magnesium	0,5-1,5 %			
Silicon	0,5-1,5 %			
Others	<0,2%			
Coating (polyester)	**-**	**~4,8%**	**-**	**~4,8%**
Thermal Break	**-**	**-**	**~12,2%**	**~12,2%**
Polyamide	-	-	75%	75%
Glass fiber	-	-	25%	25%

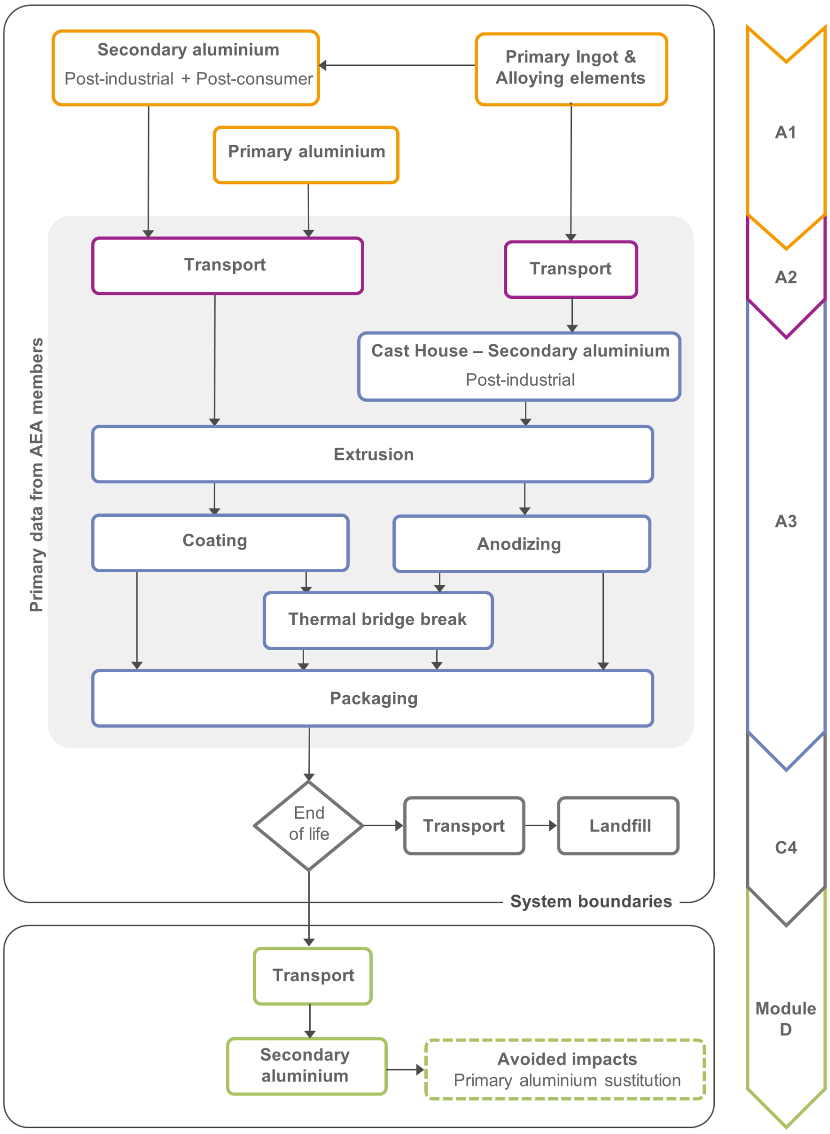
reported only the net benefits of recycling, i.e. the recycling benefits at the end of life minus the benefits already considered in the module A1 due to secondary aluminium content. In this EPD, the scrap not collected at the end of life is sent to landfill.

The average metal composition, based on metal feedstock information collected from the companies participating in this EPD, is shown in the following table.

Aluminium Source	%
Primary aluminium (including alloying elements)	61
Secondary aluminium from post-industrial scrap	27
Secondary aluminium from post-consumer scrap	12

System boundaries

The scope of the study is set to be "Cradle-to-gate with options". Processes included in the assessment are presented on the diagram below.



LCA INFORMATION

Declared unit

The declared unit is the production of 1 kg of aluminium profile for construction use including the surface treatment (coating or anodization) and the optional thermal bridge break.

To obtain the environmental information referred to a 1 meter of profile, conversion factors are provided for 4 products: anodized profile, 0.592 kg/m; thermal break anodized profile, 0.550 kg/m; coated profile, 0.576 kg/m; and thermal break coated profile, 0.534 kg/m.

Goal and scope

This EPD evaluates the environmental impacts of 1 kg aluminium profile product from cradle to gate with option (disposal). This EPD is the basis for B2B communication. Intended use clients and relevant stakeholders within the building sector.

System boundaries

This EPD provides information on the production stage of the aluminium profiles (raw material supply, transport to plants and manufacturing) with disposal at end-of-life. Recycling potential of aluminium with burdens saving due to use in a second product systems is also reported (module D).

Time representativeness

All primary data used in this EPD are based on the 2017 production data for aluminium profiles manufactured by AEA members in their facilities in Spain.

Database(s) and LCA software used

The data for primary aluminium billet and for scrap remelting (secondary aluminium billet) are based on LCI dataset published by European Aluminium in february 2018 and are the best available. For transport processes the ELCD 3.2 database was consulted. Other LCI datasets were sourced from the Ecoinvent v3.3. In the case of thermal bridge break profiles, the manufacturers supplying the majority of the AEA members have provided EPDs (fulfilling 15804 specifications) of their products

The LCA study was performed using an excel-based model. The impact assessment results were calculated using characterization factors published by the University of Leiden's Centre of Environmental Sciences (CML 2001) obtained from Simapro software.

Data Quality

In order to achieve precision, consistency and representativeness and to ensure reliable results, first-hand industry data were used. All foreground data were collected from AEA participating companies for their facilities using customized data collection templates. It was created representative production-weighted inventories. These inventories are intended to represent average of aluminium profile production for building by AEA members. The age of these data is less than two years. As for bibliographic data, none has been used with a year of publication lower than 2011.

Regionally specific datasets were used to model the energy consumption (electricity, natural gas or diesel). For the processes of transport, production of raw materials or end-of-life, datasets were chosen according to their technological and geographical representation of the actual process. The technological and geographical representativeness of 76% of the processes included in the LCA is guaranteed, among which are the most contributing to final results. For 18% of the processes, only geographical or technological representativeness is guaranteed. For the rest of the processes, proxy datasets were used to address the lack of data for a specific process or for a specific geographical region.

Estimates and Assumptions

It was not possible to distinguish the consumption of electricity and natural gas between the production stages of profiles. Based on the total energy consumption in the plants, electricity and natural gas used in the different stages was estimated under the criteria of the technical staff of plants. Total energy consumption was attributed entirely to extrusion, coating, anodizing and cast house. The contribution of packaging and thermal bridge break to electricity consumption is not relevant (but it is included in the rest of processes).

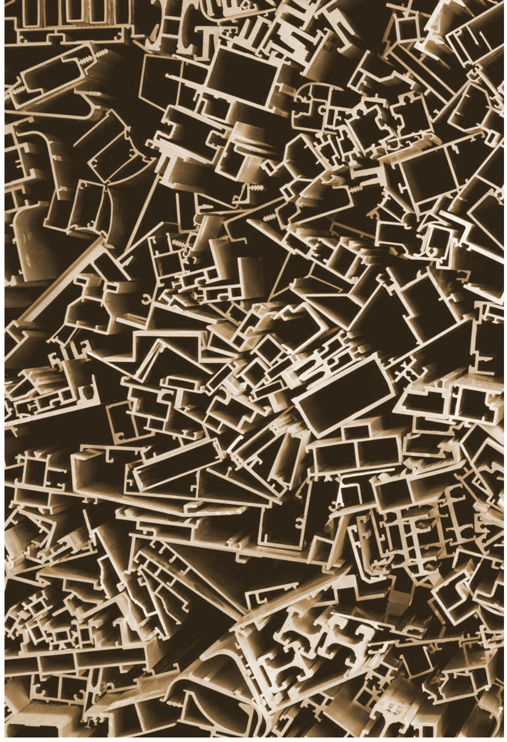
Once the energy consumption was attributed to extrusion, coating, anodizing and cast house, it was apportioned among the total production of semi-finished products for each stage. It has proceeded in the same way for raw materials and waste generation.

Because tens of different chemicals are used for surface treatments before anodizing and coating, their consumption were modeled based on the surface of an average profile. The surface treatments chosen are the most complete and those that require the use of the greatest amount of chemicals per square meter of treated surface, thus attending to a conservative assumption.

Billets are made from 100% primary aluminium or nearly 100% secondary aluminium (from post-industrial and post-consumer scrap). Billet manufacturers have provided production data for both in order to calculate the recycled

Production			Construction		Use							End-of-life				Resource recovery
Raw Materials Supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction and demolition	Transport	Waste processing	Disposal	Reuse, recovery or recycling potentials
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	MND	MND	MND	X	X

X = declared module; MND = module not declared



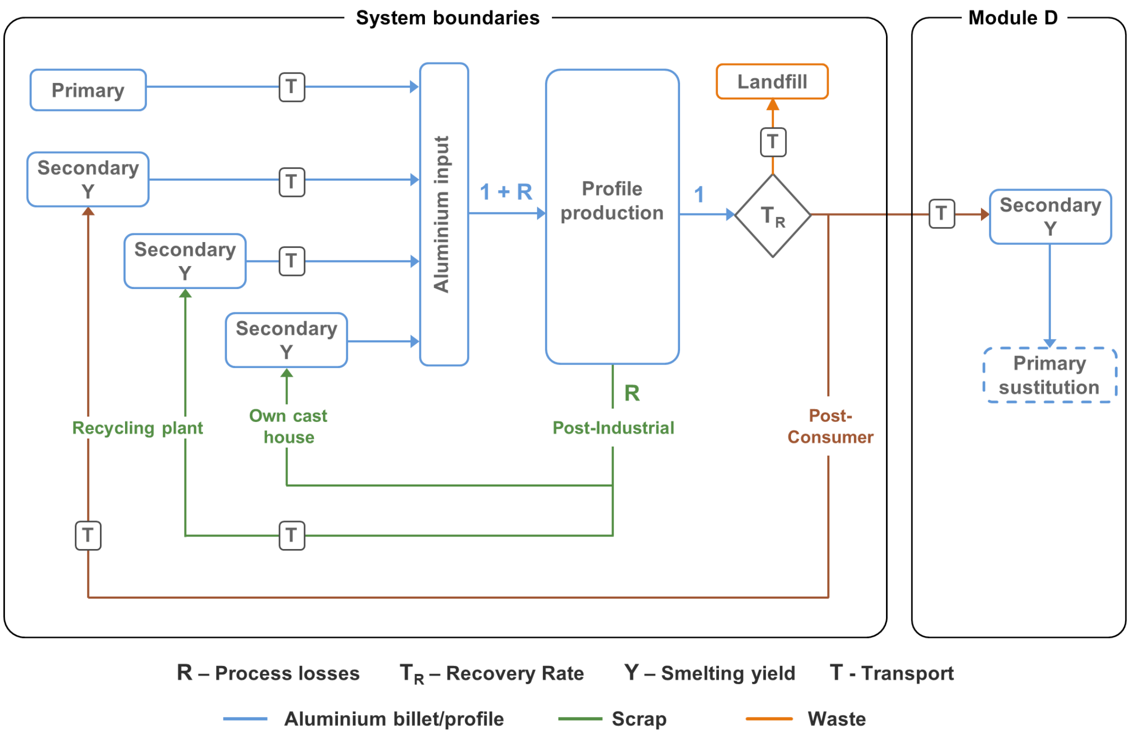
content in the aluminum input to the product system.

All scrap was modeled as burden free when entering the system but it was included transport to the recycling sites for post-industrial scrap from AEA members.

Disposal and recovery rates for building are modelled based on figures reported by the European Aluminium Association (see references). It was assumed a 95% for recovery rate while the remaining 5% goes to landfill.

Allocation

Scrap inputs to the production stage are subtracted from scrap to be recycled at end of life in order to obtain the net scrap output from the product system. This remaining net scrap is then sent to recycling. Module D report the environmental aspects of recycled scrap generated at the end of life minus that used at the production stage. Loads and benefits are assessed at the point of functional equivalence, i.e. where the substitution of primary aluminium takes place. In the recycling process, smelting yield for each scrap fraction was taken into account.



RESULTS

		ANODIZED ALUMINIUM PROFILE (1 Kg)			COATED ALUMINIUM PROFILE (1 Kg)		
ENVIRONMENTAL IMPACTS	UNIT	A1-3	C4	D	A1-3	C4	D
GWP	kg CO_2 eq	11,8	8,88E-04	-3,96	10,3	1,86E-03	-3,45
ODP	kg CFC-11 eq	3,03E-06	1,58E-11	-2,02E-11	2,32E-06	3,15E-11	-1,76E-11
AP	kg SO_2 eq	7,95E-02	3,20E-06	-2,02E-02	5,96E-02	3,54E-06	-1,76E-02
EP	kg PO_4^{-3} eq	4,15E-03	2,02E-05	-1,17E-03	3,38E-03	1,93E-05	-1,02E-03
POCP	kg C_2H_4 eq	4,26E-03	2,81E-07	-1,07E-03	3,61E-03	3,18E-07	-9,33E-04
ADPE	kg Sb eq	1,20E-05	4,04E-11	-1,93E-06	5,59E-06	1,12E-10	-1,68E-06
ADPF	MJ	3,99E+02	9,56E-03	-4,15E+01	3,28E+02	1,02E-02	-3,62E+01
RESOURCE USE	UNIT	A1-3	C4	D	A1-3	C4	D
PERE	MJ	40,2	1,70E-04	-22,3	37,0	2,27E-04	-19,4
PERM	MJ	0	0	0	0	0	0
PERT	MJ	40,2	1,70E-04	-22,3	37,0	2,27E-04	-19,4
PENRE	MJ	4,20E+02	1,01E-02	-4,88E+01	3,45E+02	1,08E-02	-4,26E+01
PENRM	MJ	0	0	0	0	0	0
PENRT	MJ	4,20E+02	1,01E-02	-4,88E+01	3,45E+02	1,08E-02	-4,26E+01
SM	kg	4,61E-01	0	4,88E-01	4,43E-01	0	4,26E-01
RSF	MJ	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0
FW	m^3	14,7	0	-1,74E-01	9,41	3,62E-04	-1,52E-01
WASTE CATEGORIES	UNIT	A1-3	C4	D	A1-3	C4	D
HWD	kg	3,99E-01	1,97E-08	-2,58E-01	3,98E-01	1,88E-08	-2,25E-01
NHWD	kg	2,19	8,66E-05	-1,20E+00	1,88	2,47E-03	-1,05E+00
RWD	kg	4,67E-03	0	-2,93E-03	4,47E-03	0	-2,56E-03
OUTPUT FLOWS	UNIT	A1-3	C4	D	A1-3	C4	D
CRU	kg	0	0	0	0	0	0
MFR	kg	2,38E-01	0	0	2,35E-01	0	0
MER	kg	0	0	0	0	0	0
EE	MJ	0	0	0	0	0	0

ENVIRONMENTAL IMPACTS	UNIT	THERMAL BREAK ANODIZED ALUMINIUM PROFILE (1 Kg) A1-3	C4	D	THERMAL BREAK COATED ALUMINIUM PROFILE (1 Kg) A1-3	C4	D
GWP	kg CO_2 eq	11,5	3,33E-03	-3,19	10,3	4,30E-03	-3,06
ODP	kg CFC-11 eq	2,69E-06	5,52E-11	-1,63E-11	2,06E-06	7,09E-11	-1,56E-11
AP	kg SO_2 eq	7,34E-02	4,04E-06	-1,62E-02	5,58E-02	4,38E-06	-1,56E-02
EP	kg PO_4^{-3} eq	4,34E-03	1,80E-05	-9,46E-04	3,67E-03	1,72E-05	-9,07E-04
POCP	kg C_2H_4 eq	4,29E-03	3,74E-07	-8,62E-04	3,71E-03	4,12E-07	-8,27E-04
ADPE	kg Sb eq	1,49E-05	2,20E-10	-1,55E-06	9,20E-06	2,92E-10	-1,49E-06
ADPF	MJ	3,72E+02	1,12E-02	-3,34E+01	3,10E+02	1,19E-02	-3,21E+01
RESOURCE USE	**UNIT**	**A1-3**	**C4**	**D**	**A1-3**	**C4**	**D**
PERE	MJ	38,5	3,15E-04	-18,0	35,7	3,72E-04	-17,2
PERM	MJ	0	0	0	0	0	0
PERT	MJ	38,5	3,15E-04	-18,0	35,7	3,72E-04	-17,2
PENRE	MJ	3,91E+02	1,17E-02	-3,93E+01	3,24E+02	1,24E-02	-3,77E+01
PENRM	MJ	0	0	0	0	0	0
PENRT	MJ	3,91E+02	1,17E-02	-3,93E+01	3,24E+02	1,24E-02	-3,77E+01
SM	kg	4,09E-01	0	3,93E-01	3,92E-01	0	3,77E-01
RSF	MJ	2,83E-04	0	0	2,83E-04	0	0
NRSF	MJ	2,95E-03	0	0	2,95E-03	0	0
FW	m^3	15,2	9,09E-04	-1,40E-01	10,6	1,27E-03	-1,35E-01
WASTE CATEGORIES	**UNIT**	**A1-3**	**C4**	**D**	**A1-3**	**C4**	**D**
HWD	kg	3,53E-01	1,74E-08	-2,08E-01	3,52E-01	1,65E-08	-2,00E-01
NHWD	kg	3,16	6,08E-03	-9,66E-01	2,88	8,46E-03	-9,27E-01
RWD	kg	4,71E-03	0	-2,36E-03	4,54E-03	0	-2,26E-03
OUTPUT FLOWS	**UNIT**	**A1-3**	**C4**	**D**	**A1-3**	**C4**	**D**
CRU	kg	0	0	0	0	0	0
MFR	kg	2,17E-01	0	0	2,14E-01	0	0
MER	kg	1,38E-03	0	0	1,38E-03	0	0
EE	MJ	4,17E-03	0	0	4,17E-03	0	0

ENVIRONMENTAL IMPACTS. GWP: Global warming potential; **ODP**: Ozone depletion potential; **AP**: Acidification potential of land and water; **EP**: Eutrophication potential; **POCP**: Photochemical ozone creation potential; **ADPE**: Abiotic depletion potential for non-fossil resources; **ADPF**: Abiotic depletion potential for fossil resources.

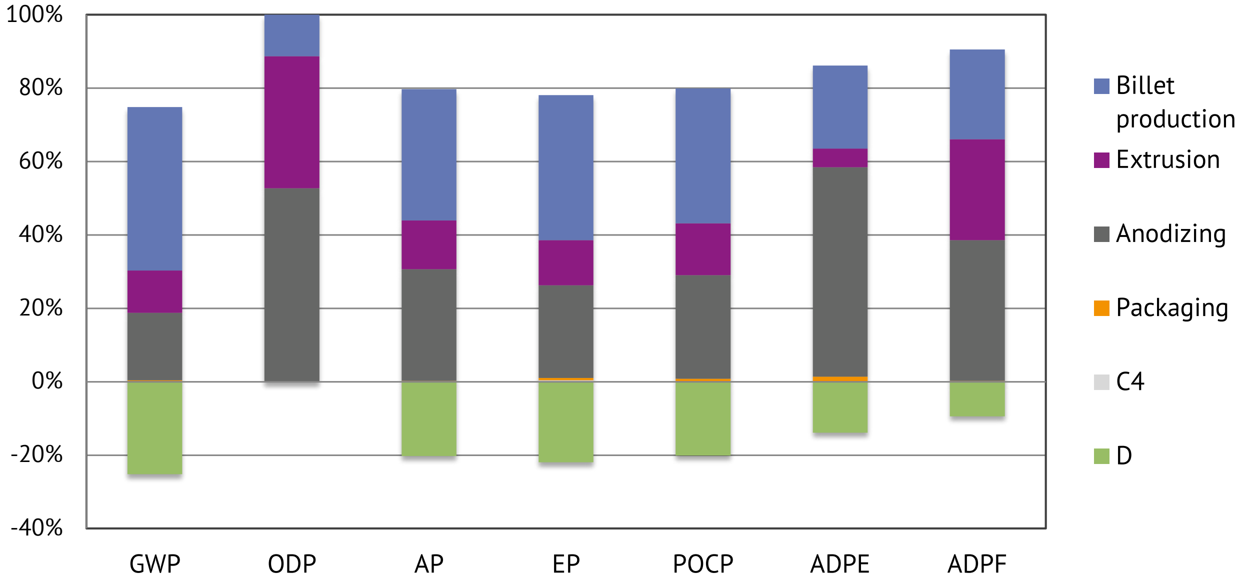
RESOURCE USE. PERE: Renewable primary energy as energy carrier; **PERM**: Renewable primary energy resource as material utilization; **PERT**: Total use of renewable primary energy resources; **PENRE**: Non-renewable primary energy as energy carrier; **PENRM**: Non-renewable primary energy as material utilization; **PENRT**: Total use of non-renewable primary energy resources; **SM**: Use of secondary materials; **RSF**: Use of renewable secondary fuels; **NRSF**: Use of non-renewable secondary fuels; **FW**: Use of net fresh water.

WASTE CATEGORIES. HWD: Hazardous waste disposed; **NHWD**: Non-hazardous waste disposed; **RWD**: Radioactive waste disposed.

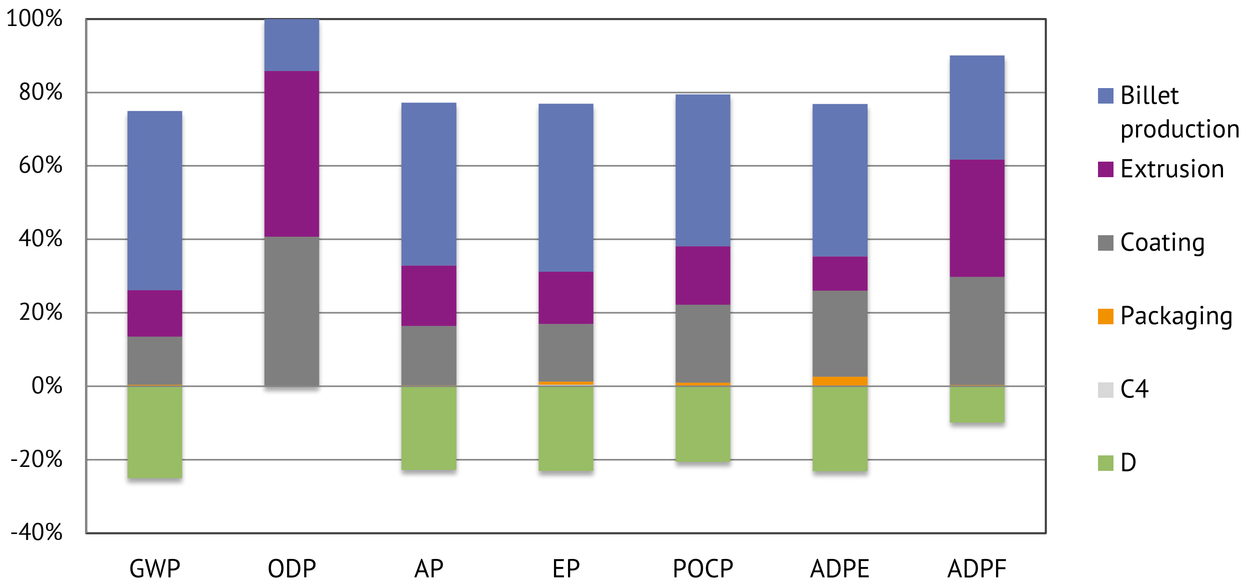
OUTPUT FLOWS. CRU: Components for re-use; **MFR**: Materials for recycling; **MER**: Materials for energy recovery; **EE**: Exported energy per energy carrier.

SUPPLEMENT INFORMATION

ANODIZED ALUMINIUM PROFILE

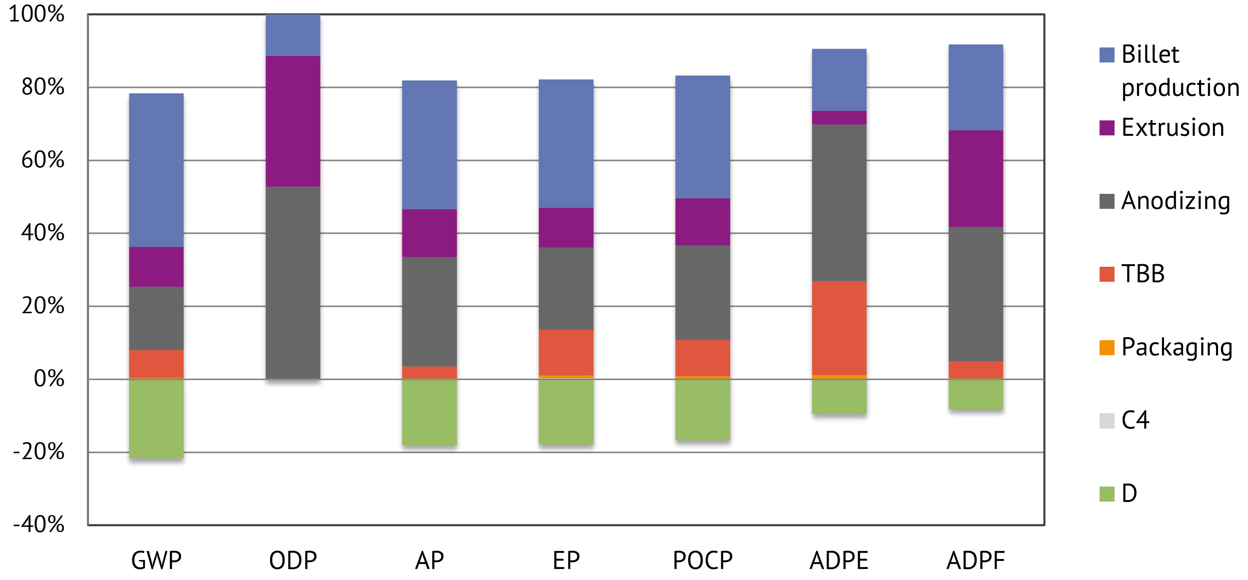


COATED ALUMINIUM PROFILE

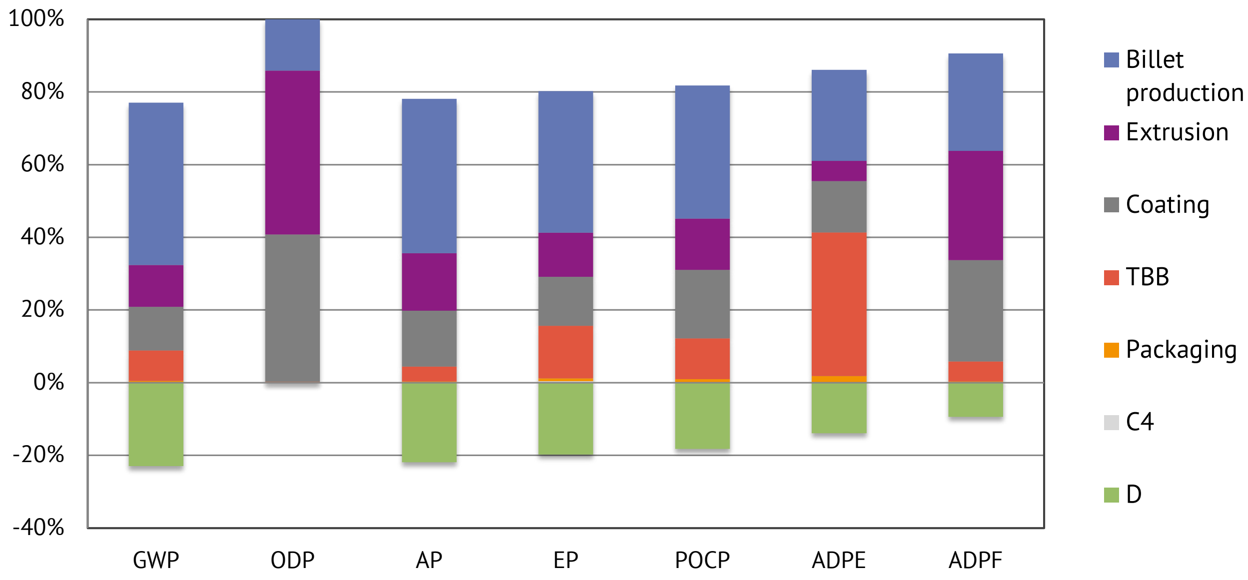


In most impact categories and indicators, anodized profiles have greater values than coated profiles. This is because the anodizing process is intensive in the use of natural gas, electricity and chemical substances used in the surface treatment. The anodizing stage shares the leading role together with billet production and becomes greater than this one for the ozone layer depletion and abiotic resources depletion (elements and fuels).

THERMAL BREAK ANODIZED ALUMINIUM PROFILE



THERMAL BREAK COATED ALUMINIUM PROFILE



TBB inclusion, either in anodized or coated profile, does not affect the overall result in relation to the coated and anodized profiles. The TBB presence replaces part of the aluminium in profile. Not only less starting aluminium is used (as raw material) but also it is necessary to extrude less amount of profile, or anodize or coat less aluminium surface. This explains the slight decrease in some impacts categories of thermal break aluminium profiles in relation to the coated and anodized profiles.

It is also noteworthy that the presence of plastic components in the profile (powder coating and/ or TBB) reduces the useful amount of aluminium to be recycled at the end of life (the avoided impacts are reduced - module D-) and it supposes a greater problem in the landfill (increasing impacts reported in C4). However, module D is in all cases a very significant reduction in all indicators due to the replacement of primary aluminum.

VERIFICATION

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025 and the requirements given in the product category rules document for Construction Products and Construction Services (EN 15804) and the general program guidelines by The International EPD® System. The results shown in this EPD are based on the LCA report for sector EPD of the Spanish Association of Aluminium of September 28, 2018 according to standard 14044.

This EPD is not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages or are based on different Product Category Rules. EPDs of construction products may not be comparable if they do not comply with EN 15804. This DAP is not representative of any particular manufacturer or any of its products; on the other hand, it is the average of the products manufactured by the members of the AEA.

The EPD owner is responsible for its content, as well as to preserve supporting documentation during the period of validity that justifies the data and statements that are included.

EPD Programme	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com
EPD registration number	S-P-01409
EPD owner	Asociación Española del Aluminio y Tratamientos de Superficie
Declared unit	1 kg of coated aluminium profile, anodized aluminium profile, thermal break coated aluminium profile and thermal break anodized aluminium profile
System boundaries	Cradle to gate with options
Published	2018 - 10 - 31
Valid until	2023 - 10 - 19
Reference year for data	2017
Geographical scope	Wordwide
Product group classification	UN CPC Code: 41532 Bars, rods and profiles, of aluminium
Product Category Rules	PCR 2012:01 Construction products and Construction services. Version 2.2. 2017-05-30. Based on CEN standard EN 15804
PCR review was conducted by	Technical Committee of The International EPD® System www.environdec.com info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:2006	[X] External [ ] Internal [ ] EPD®
Third-party verifier	Centro Tecnológico de Miranda de Ebro www. ctme.es evamtz@ctme.es
EPD prepared by	IDNÓVAM Innovación y desarrollo para el ambiente info@idnovam.com

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- ISO 14025/ DIN EN ISO 14025:2009-11: Environmental labels and declarations - Type III environmental
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CONTACTS

EPD PROGRAMME

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