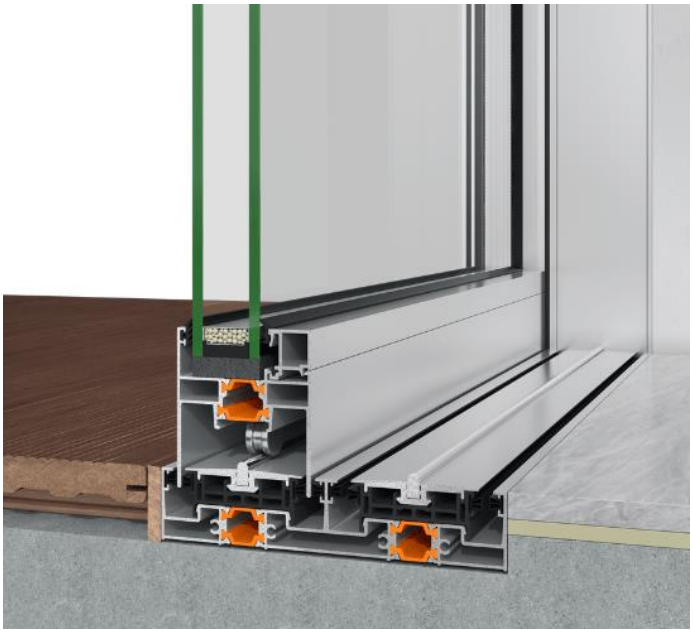
EUROPEAN ALUMINIUM



ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 and EN 15804:2012 + A2:2019

Minimal sliding insulated system SMARTIA M630 PHOS

Alumil

Owner of the declaration:	
Publisher and Programme holder:	EUROPEAN ALUMINIUM
Declaration number:	EPD-2022-0006
Issue date:	2022-05-10
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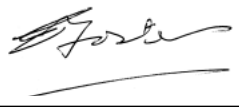
www.european-aluminium.eu

GENERAL INFORMATION

Owner of the declaration	Alumil S.A Kilkis Industrial Area 61100 Kilkis Greece +30 2313 011 000 www.alumil.com
Manufacturer	Alumil S.A Kilkis Industrial Area 61100 Kilkis Greece
Publisher and Programme holder	EUROPEAN ALUMINIUM AISBL Avenue de Tervueren 168 B-1150 Brussels, Belgium  Paul Voss, Director General
The declaration is based on the Product Category Rules	European Aluminium General Programme Instructions version 3, 23rd of September 2020
Declared Unit	1 m^2 of Minimal sliding insulated system SMARTIA M630 PHOS
Scope of the Environmental Product Declaration	This EPD covers 1 m^2 of minimal sliding insulated system type SMARTIA M630 PHOS double glazing. This EPD has been developed from a modelling tool developed by Ecoinnovazione via an i-report in GaBi. Among the product family, one representative product has been selected and corresponding EPD results have been calculated based on specific bill of materials. The results generated by the collective tool can be considered as a good proxy to model minimal sliding insulated system produced by Alumil S.A. UN CPC 54710 Glazing Services. The EPD may be used in a B2B context within the European Market.
Liability	The owner of the declaration is liable for the underlying manufacturing information and European Aluminium is not liable in this respect.
Disclaimers	This EPD cannot be used as a guarantee of the recycled content of the actual product sold on the market. A specific declaration may be asked to the supplier. The use of this EPD within BIM tools is in principle limited to the products explicitly included in the EPD. The scaling of results to model similar products can only be done if justified and transparently reported in the project report. Any responsibility regarding the misuse of this EPD by third parties is not accepted by the Programme Operator.

Verification	Verifier
EN15804:2012 +A2:2019 serves as core PCR completed by European Aluminium PCR 03/2020	Chris Foster, EuGeos 
Verification of the EPD by an independent third party in accordance with ISO 14025	
☐ Internally ☒ Externally	

1 PRODUCT

1.1 Product description and applications

This Environmental Product Declaration (EPD) is for business-to-business communication. The sliding system SMARTIA M630 PHOS offers a minimal touch in contemporary residences combining minimal design with high thermal performance. Following the “less is more” philosophy, all aluminium profiles can be hidden into the wall providing a total sense of comfort with top functionality and enhanced safety.

The representative product is a double-glazed minimal sliding insulated system of 2,18 m high by 3 m wide as sketched in Figure 1.

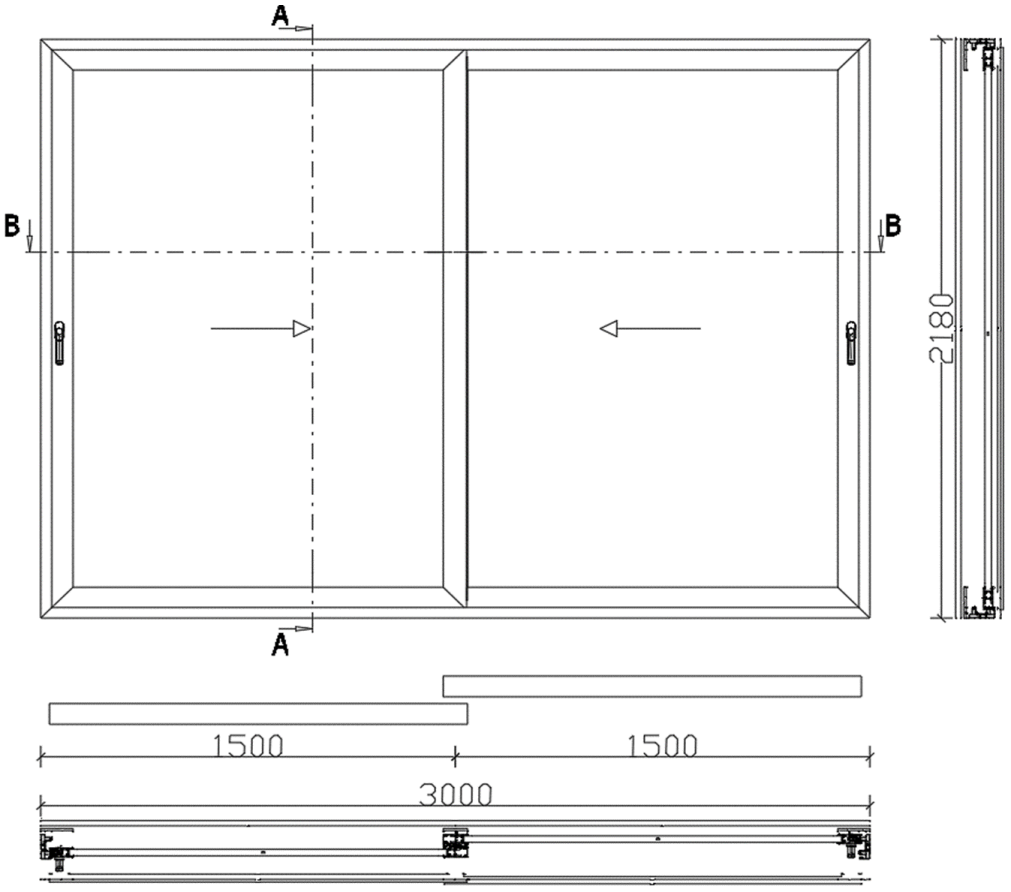


Figure 1 Sketch of the representative product for the minimal sliding insulated system

The calculated BoM considers 100% of the mass of the profiles located at the border of the representative product.
EPD results have been calculated for one representative product, which is detailed in Table 1. There is no integration of operable windows in the representative product.

Table 1 Details representative product

ID	Model	Size (W x H)	Glazing	Glass surface area (m^2)	Glass thickness (mm)
1	SMARTIA M630 PHOS double glazing	3 m x 2,18 m	Double	2,91	8 mm

1.2 Technical Data

The most relevant technical data are reported in Table 2.

Table 2 Most relevant technical data

Category	Description & value	Standards
Thermal insulation	1,43 W/m^{2}K	EN 10077-2
Air permeability	CLASS 3	EN 1026, EN12207
Water tightness	CLASS 7A	EN 1027, EN 12208
Wind load resistance	CLASS C5/B5	EN 12210, EN 12211
Sound reduction	Rw (C;Ctr) = 42 dB	EN 14351, EN 717

For the most up-to-date values of the technical data, please refer to the product specifications available on the Alumil S.A website (see the specifications for SMARTIA M630 PHOS product in the section www.alumil.com/international/homeowners/products).

The most relevant standard for applications of aluminium minimal sliding insulated systems in buildings is EN 13830.

1.3 Process description

The entire installation process is typically performed at the job site.

The following operations are carried out for the production of the main parts:

1. Aluminium profile (powder coated) preparation mainly via sawing, and milling.
2. Frame production by assembling the various profiles via connectors and fixing via bolting or glueing. Connectors used are mostly composed of aluminium.
3. Positioning and fixing the various gaskets.
4. Infill application (e.g. glazing, opaque panels).
5. The hardware integration (if relevant).

The main background production processes are reported in Figure 2.

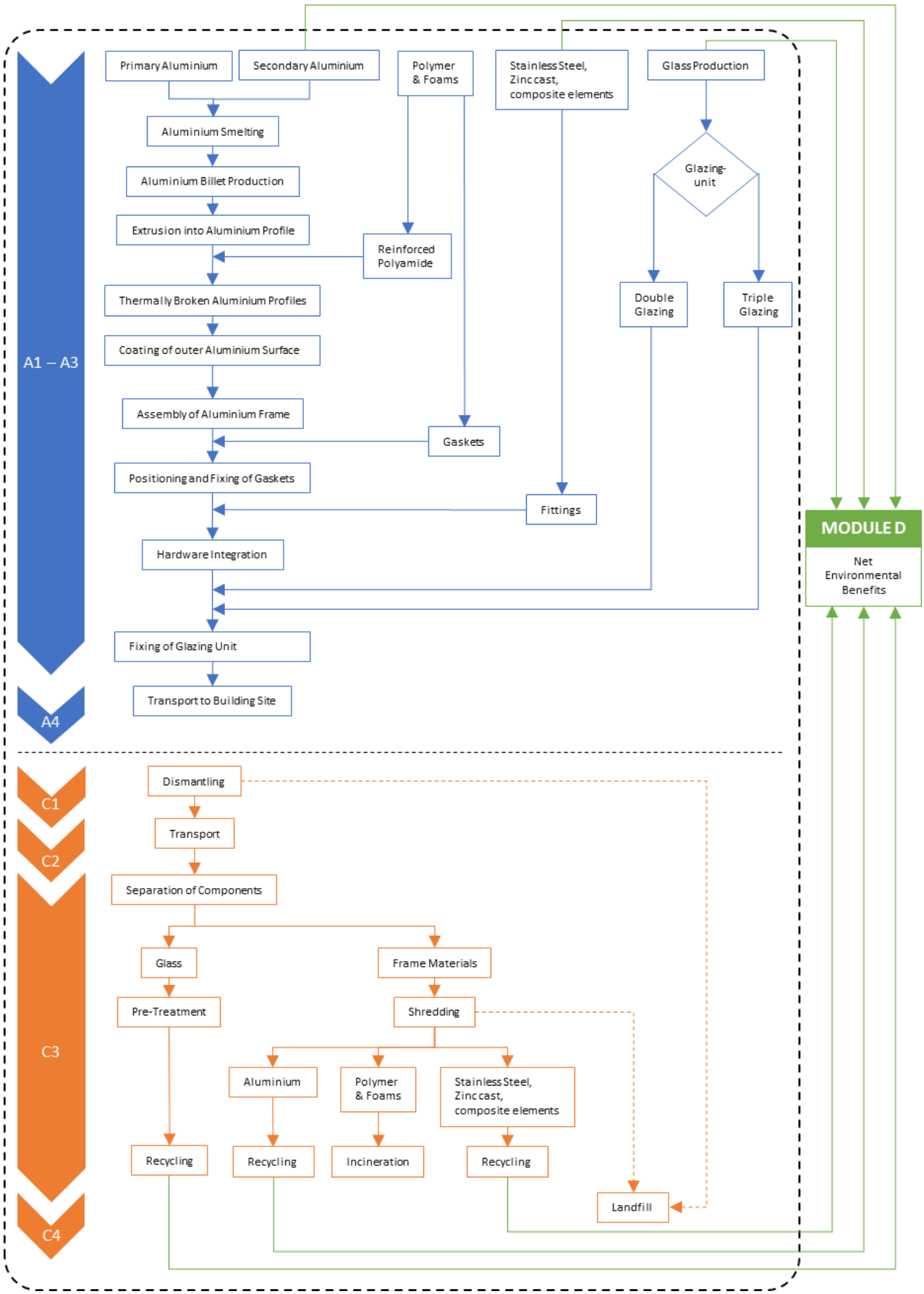


Figure 2 Main production processes and components of the minimal sliding insulated system

The upstream aluminium processes have been modelled using European Aluminium LCI datasets for the primary aluminium production, recycling and remelting as described in the European Aluminium Environmental profile report 2018.

For the other processes and materials, e.g. gaskets, glass unit or hardware, datasets from the GaBi database have been used. The powder coating of aluminium profiles has been modelled using GaBi datasets as well.

At end-of-life, thanks to their high price value (i.e. about 50% of the LME price) aluminium frames and profiles are systematically dismantled and collected for sending them to recycling. After been collected, the minimal sliding insulated systems are treated through shredding and sorting. However, the glazing unit might not be systematically collected at the building renovation or demolition site. Hence, two extreme end-of-life scenarios have been used for flat glass: 100% recycling or 100% landfilling.

1.4 Health and safety aspects during production and installation

There are no critical health and safety aspects during the production of aluminium minimal sliding insulated systems. The pre-treatments used for the pre-treatment of aluminium profile do not contain chromium nor other substances of very high concern (SVHC substances), and this process is followed by a coating process realised using a powder without VOC.

There are no relevant aspects of occupational health and safety during the further processing and installation of Alumil S.A minimal sliding insulated systems. Under normal installation, no measurable environmental impacts can be associated with the use of Alumil S.A minimal sliding insulated systems. The appropriate safety measures need to be taken at the building site, especially if installation takes place on a high-rise building.

1.5 Reference service life

Since the use phase is not modelled, no specific information can be given about the Reference Service Life. In normal use, aluminium building products are not altered or corroded over time. A regular cleaning (e.g. once a year) of the product suffices to secure a long service life. However, the use of highly alkaline (pH >10) or highly acidic (pH < 4) cleaning solutions should be avoided. In practice, a service life of 50 years can be assumed in normal use for such application, with the exception of the IGU (Insulated Glass Unit) which needs to be replaced usually after 30 years due to a slow degradation of its performance

2 LCA – CALCULATION RULES

2.1 Declared unit & bill of materials

The Bill of Material of the analysed product is reported in Table 3. The declared unit corresponds to 1m^2 of minimal sliding insulated system.

Table 3 Bill of materials (kg) of the declared unit

Reference		
Type	**M630 PHOS**	
	kg	**%**
Glass	8,9	46%
Aluminium	8,1	42%
Metal parts	0,60	3,1%
Thermal break	0,87	4,5%
Gasket	0,30	1,5%
Foams	0	0%
Polymers	0,52	2,7%
Total	**19,28**	**100%**

2.2 System boundary

This EPD is from cradle to gate with modules C1-C4 and module D, as reported in Table 4.

The production stage (modules A1-A3) includes processes that provide materials and energy input for the system, manufacturing and transport processes up to the factory gate, as well as waste processing. For the end-of-life, the default scenario defined in the General Product Instructions and detailed in 3.2 is applied.

Production			Installation		Use stage							End-of-Life				Next product system
Raw material	Transport	Manufacturing	Transport to	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy	Operational water	Deconstruction	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	X	X	X	X	X

Table 4 Modules declared

Note: ND: Not Declared; X: Module included in the LCA.

Module A4 is declared for a distance of 1 km to give the possibility to adjust the resulting environmental impact depending on the specific distance at hand.

2.3 Energy mix

In the models developed the background electricity mix used is the European electricity mix (EU-28 Electricity grid mix (2017)). Details about the electricity modelling in the datasets: production of

primary aluminium, extrusion, rolling and recycling please refer to the Environmental Profile Report 2018.

2.4 Allocation

The scrap which are produced along the production chain are recycled into the same production chain and are modelled as "closed-loop" within Module A. This recycling loop has been modelled in the GaBi model so that the minimal sliding insulated system is the only product exiting the gate. Hence, the production process does not deliver any co-products.

At the end-of-life stage, the minimal sliding insulated systems are sent to an end-of-life treatment which is modelled according to the scenario reported in 3.2. The environmental burdens and benefits of recycling and energy recovery are calculated in module D accordingly.

2.5 Assumptions and Cut-off criteria

The aluminium profiles were composed of a mix of 60% primary aluminium and 40% recycled aluminium. Such mix represents the typical sourcing of aluminium in Europe, all markets included. For the primary aluminium, a primary aluminium ingot consumption mix was considered (European production + net fraction of imports into Europe). Alloying elements were not considered, and a pure aluminium profile has been assumed as a proxy.

The EPD makes use of industry average data. No specific data were collected and used to model the fabrication stage, which has a limited impact on the full life cycle profile of the minimal sliding insulated systems. Hence, no specific LCA modelling has been done on that process step, except a scrap rate of 5% for the aluminium profile which has been considered. All other known operating data was taken into consideration in the analysis.

2.6 Data quality

Representativeness

Technological: All primary and secondary data were modelled to be specific to the technologies or technology mixes under study. Where technology-specific data were unavailable, proxy data were used. For the aluminium production, extrusion profiles and recycling, the datasets described in the Environmental Profile Report 2018 of European Aluminium have been used. The modelling reflects the specific BoM of the analysed products. Technological representativeness is considered to be very good.

Geographical: All primary data were collected specifically to the countries under study. Regarding secondary data, where EU region-specific data were unavailable, DE datasets were used. For the aluminium production, extrusion profiles and recycling, the datasets described in the Environmental Profile Report 2018 of European Aluminium have been used. Alumil's plants are based in Greece, Serbia, Bosnia & Herzigovina, Albania and Romania. Geographical representativeness is considered to be good.

Temporal: Primary data refer to the year 2020, and all secondary data come from the GaBi database SP40, including those on aluminium production, which are the most recent ones as described in the Environmental Profile Report 2018 of European Aluminium.

Completeness

All known operating data was taken into consideration in the analysis. Based on earlier studies conducted by European Aluminium, it can be assumed that the ignored processes or flows contribute to much less than 5% of the impact categories under review.

The process chain is considered sufficiently complete regarding the goal and scope of this study.

Overall, the data quality can be described as good.

2.7 Software and databases

These EPD results have been calculated from an LCA tool for EPD, based on the GaBi database. Currently, the EPD software is using the software GaBi V10.5.1da).

2.8 Comparability

As a general rule, a comparison or evaluation of EPD data may be possible when all of the data to be compared has been drawn up in accordance with EN 15804 and the building context or product-specific characteristics are taken into consideration.

3 LCA – SCENARIOS AND ADDITIONAL INFORMATION

3.1 Scenario for additional modules

Module A4 is taken into consideration in this Declaration, and it has been modelled according to the information reported in Table 5.

Table 5 Module A4 – Transport to the building site

Scenario information	Unit (expressed per DU)
Fuel type and consumption of vehicle or vehicle type used for transport e.g. long-distance truck, boat, etc.	Truck-trailer, Euro 4, 34 - 40t gross weight / 27t payload capacity, diesel driven
Distance	1 km
Capacity utilisation (including empty returns)	61 %
Bulk density of transported products	-
Volume capacity utilisation factor (factor = 1 or <1 or ≥1 for compressed or nested packaged products)	Not applicable

3.2 Scenario for Mod. C1-C4

The default scenario for the end-of-life of the minimal sliding insulated system, as reported in the General Programme Instructions, is the following:

- collection rate: 99%;
- shredding efficiency: 95%;
- scrap recycled through refining process: 96,5%
- overall aluminium recycling rate: 91%

For the glass used in the sliding systems, two extreme end-of-life scenarios were modelled: one with 100% recycling of the glass and one with 100% landfill of the glass.

Table 6 reports the main parameters of the end-of-life scenarios for the main materials and components.

Table 6 Parameters of the end-of-life scenarios for the main materials and components, related to the DU

Processes	Unit (expressed per FU or DU of components, products or materials and by type of material)	M630 PHOS
Collection process specified by type	Kg collected separately	Glass: 8,9 kg
		Aluminium frame: 8,04 kg
		Gasket: 0,294 kg
		Metal fittings and others: 1,452 kg
	Kg collected with mixed construction waste	0
Recovery system specified by type	Kg for re-use	0
	Kg for recycling	Glass: 8,61 kg (scenario 100% glass recycling)
		Aluminium frame: 7,18 kg
		Metal fittings: 0,565 kg
	Kg for energy recovery	Gasket: 0 kg
		Others: 0 kg
Disposal specified by type	Kg product or material for final deposition	Aluminium frame: 0,454 kg
		Gasket: 0,0176 kg
		Fittings and others: 0,1224 kg
		Glass: 8,9 kg (scenario 100% glass landfill)

Note to Table 6:

Material collected separately: This amount refers to the waste stream collected separately per material before being subjected to shredding

Material for recycling: This amount refers to the waste stream sent to recycling per material after the shredding and/or sorting process.

Material for final deposition – aluminium: this amount includes the aluminium not collected separately and the shredding losses.

3.3 Scenario Mod. D

Module D includes:

- a transport from the scrap dealers to the recycling plants, considering an average distance of 200 km;
- recycling of Aluminium through refining;
- a net credit for the avoided production of primary aluminium;

The calculation of module D has been implemented in line with the General Programme Instructions of European Aluminium, thus based on the difference between the scrap used at the input and output side. In some cases, this may result in environmental burdens instead of environmental benefits if the product system is a net consumer of valuable secondary material.

3.4 Additional environmental information

During use, the indoor air quality, i.e. VOC emission, is not affected by aluminium minimal sliding insulated systems. In case of fire, aluminium is a non-combustible construction material (European Fire Class A1) in accordance with Commission Decision 96/603/EC and does therefore not make any contribution to fire.

4 LCA RESULTS – MINIMAL SLIDING INSULATED SYSTEM M630 PHOS-Double glazing

4.1 Result of the LCA – Environmental impact minimal sliding insulated system M630 PHOS-Double glazing, 1 m^2

The tables below report the results of the LCA study for the two glass scenarios: 100% recycling and 100% landfill.

4.1.1 Core environmental impact indicators

Scenario 100% glass recycling

Table 7 Core environmental impact indicators for 1 m^2 minimal sliding insulated system M630 PHOS-Double glazing, ***scenario 100% glass recycling***

Impact category	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP - total	kg CO_2 eq.	8,67E+01	9,41E-04	9,22E-02	1,96E-01	6,54E-01	3,34E+00	-2,51E+01
GWP – fossil	kg CO_2 eq.	8,66E+01	9,35E-04	9,18E-02	1,94E-01	5,59E-01	3,34E+00	-2,50E+01
GWP – biogenic	kg CO_2 eq.	4,91E-02	4,70E-07	1,55E-04	9,77E-05	9,29E-02	2,17E-04	-4,89E-02
GWP - luluc	kg CO_2 eq.	4,99E-02	6,07E-06	1,89E-04	1,26E-03	2,61E-03	3,62E-04	-6,16E-03
ODP	kg CFC 11 eq.	4,70E-10	2,42E-19	1,91E-15	5,03E-17	8,61E-15	2,48E-15	-1,37E-10
AP	mol H^+ eq.	3,88E-01	5,28E-06	2,23E-04	1,10E-03	8,44E-04	2,88E-03	-1,37E-01
EP - freshwater	kg PO_4^{3-} eq.	3,36E-04	1,94E-09	2,38E-07	4,04E-07	1,85E-06	1,78E-06	-1,38E-05
EP - marine	kg N eq.	8,56E-02	2,60E-06	6,66E-05	5,41E-04	4,40E-04	1,37E-03	-2,12E-02
EP - terrestrial	mol N eq.	9,27E-01	2,88E-05	7,15E-04	5,98E-03	4,93E-03	1,55E-02	-2,55E-01
POCP	kg NMVOC eq.	2,37E-01	4,98E-06	1,83E-04	1,03E-03	8,21E-04	3,56E-03	-6,07E-02
ADP-MM (**)	kg Sb eq.	2,39E-04	8,22E-11	2,44E-08	1,71E-08	1,10E-07	3,80E-08	-5,19E-05
ADPF (**)	MJ	1,20E+03	1,25E-02	1,57E+00	2,60E+00	3,21E+00	3,51E+00	-3,05E+02
WDP (**)	m^3	2,38E+01	3,68E-06	1,28E-02	7,64E-04	4,27E-02	3,24E-01	-3,44E+00

Note: GWP – Global Warming Potential; ODP – Ozone Depletion; AP – acidification potential for soil and water; EP – Eutrophication potential; POCP – formation potential of tropospheric ozone; ADP - MM – abiotic depletion potential for non fossil resources; ADPF – Abiotic depletion potential for fossil resources; WDP – Water deprivation potential.

(**) **Disclaimer**: the results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

Scenario 100% glass landfill

Table 8 Core environmental impact indicators for 1 m² minimal sliding insulated system M630 PHOS-Double glazing, ***scenario 100% glass landfill***

Impact category	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP - total	kg CO_2 eq.	8,67E+01	9,41E-04	9,22E-02	1,30E-01	3,15E-01	3,47E+00	-1,96E+01
GWP – fossil	kg CO_2 eq.	8,66E+01	9,35E-04	9,18E-02	1,30E-01	3,12E-01	3,47E+00	-1,95E+01
GWP – biogenic	kg CO_2 eq.	4,91E-02	4,70E-07	1,55E-04	6,52E-05	1,94E-03	-3,69E-03	-4,28E-02
GWP - luluc	kg CO_2 eq.	4,99E-02	6,07E-06	1,89E-04	8,42E-04	7,61E-04	7,58E-04	-3,62E-03
ODP	kg CFC 11 eq.	4,70E-10	2,42E-19	1,91E-15	3,35E-17	9,82E-15	3,00E-15	-1,37E-10
AP	mol H^+ eq.	3,88E-01	5,28E-06	2,23E-04	7,32E-04	5,35E-04	3,84E-03	-1,07E-01
EP - freshwater	kg PO_4^{3-} eq.	3,36E-04	1,94E-09	2,38E-07	2,70E-07	1,32E-06	2,01E-06	-9,62E-06
EP - marine	kg N eq.	8,56E-02	2,60E-06	6,66E-05	3,61E-04	1,50E-04	1,62E-03	-1,49E-02
EP - terrestrial	mol N eq.	9,27E-01	2,88E-05	7,15E-04	3,99E-03	1,57E-03	1,82E-02	-1,63E-01
POCP	kg NMVOC eq.	2,37E-01	4,98E-06	1,83E-04	6,90E-04	3,78E-04	4,32E-03	-4,54E-02
ADP-MM (**)	kg Sb eq.	2,39E-04	8,22E-11	2,44E-08	1,14E-08	1,19E-07	5,07E-08	-5,17E-05
ADPF (**)	MJ	1,20E+03	1,25E-02	1,57E+00	1,74E+00	3,95E+00	5,30E+00	-2,44E+02
WDP (**)	m^3	2,38E+01	3,68E-06	1,28E-02	5,10E-04	7,01E-03	3,39E-01	-2,92E+00

Note: GWP – Global Warming Potential; ODP – Ozone Depletion; AP – acidification potential for soil and water; EP – Eutrophication potential; POCP – formation potential of tropospheric ozone; ADP - MM – abiotic depletion potential for non fossil resources; ADPF – Abiotic depletion potential for fossil resources; WDP – Water deprivation potential.

(**) **Disclaimer**: the results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

4.1.2 Additional environmental impact indicators

Scenario 100% glass recycling

Table 9 Additional environmental impact indicators for 1 m² minimal sliding insulated system M630 PHOS-Double glazing, ***scenario 100% glass recycling***

Impact category	Unit	A1-A3	A4	C1	C2	C3	C4	D
Particular Matter emissions	Disease incidence	4,62E-06	1,81E-11	2,06E-09	3,76E-09	2,25E-09	1,75E-08	-1,86E-06
Ionising radiation - human health (*)	[kBq U235 eq.]	8,26E+00	1,14E-06	3,46E-02	2,38E-04	-3,87E-03	1,17E-02	-2,94E+00
Eco-toxicity (freshwater) (**)	[CTUe]	1,41E+03	1,04E-02	7,26E-01	2,16E+00	3,19E+00	2,43E+00	-5,62E+02
Human toxicity - cancer effects (**)	[CTUh]	9,48E-07	2,06E-13	1,94E-11	4,28E-11	1,22E-10	1,10E-10	-6,23E-09
Human toxicity - non-cancer effects (**)	[CTUh]	2,09E-06	1,08E-11	7,83E-10	2,24E-09	3,05E-09	1,06E-08	-2,29E-07
Land Use related impacts/ Soil quality (**)	dimensionless	2,09E+02	3,93E-03	4,96E-01	8,16E-01	2,72E+00	7,02E-01	-1,34E+01

(*) **Disclaimer**: This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.
(**) **Disclaimer**: the results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

Scenario 100% glass landfill

Table 10 Additional environmental impact indicators for 1 m² minimal sliding insulated system M630 PHOS-Double glazing, ***scenario 100% glass landfill***

Impact category	Unit	A1-A3	A4	C1	C2	C3	C4	D
Particular Matter emissions	Disease incidence	4,62E-06	1,81E-11	2,06E-09	2,51E-09	3,95E-09	2,94E-08	-1,51E-06
Ionising radiation - human health (*)	[kBq U235 eq.]	8,26E+00	1,14E-06	3,46E-02	1,59E-04	3,66E-02	1,36E-02	-2,80E+00
Eco-toxicity (freshwater) (**)	[CTUe]	1,41E+03	1,04E-02	7,26E-01	1,44E+00	1,58E+00	3,45E+00	-7,94E+01
Human toxicity - cancer effects (**)	[CTUh]	9,48E-07	2,06E-13	1,94E-11	2,85E-11	2,18E-10	2,61E-10	-5,33E-09
Human toxicity - non-cancer effects (**)	[CTUh]	2,09E-06	1,08E-11	7,83E-10	1,49E-09	1,80E-09	2,71E-08	-1,27E-07
Land Use related impacts/ Soil quality (**)	dimensionless	2,09E+02	3,93E-03	4,96E-01	5,44E-01	1,95E+00	1,06E+00	-9,81E+00

(*) **Disclaimer**: This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.
(**) **Disclaimer**: the results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

4.2 Result of the LCA – Resource use minimal sliding insulated system M630 PHOS-Double glazing, 1 m²

The tables below report the results of the resource use for the two glass scenarios: 100% recycling and 100% landfill.

Scenario 100% glass recycling

Table 11 Resource use for 1 m² minimal sliding insulated system M630 PHOS-Double glazing, ***scenario 100% glass recycling***

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
PERE	MJ	3,26E+02	7,27E-04	6,61E-01	1,51E-01	1,57E+00	6,67E-01	-1,10E+02
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	3,26E+02	7,27E-04	6,61E-01	1,51E-01	1,57E+00	6,67E-01	-1,10E+02
PENRE	MJ	1,15E+03	1,25E-02	1,57E+00	2,60E+00	3,21E+00	3,51E+00	-3,05E+02
PENRM	MJ	5,00E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	1,20E+03	1,25E-02	1,57E+00	2,60E+00	3,21E+00	3,51E+00	-3,05E+02
SM	kg	3,75E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	7,71E-01	6,46E-07	6,43E-04	1,34E-04	1,22E-03	7,91E-03	-2,80E-01

Note: PERE – use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM – use of renewable primary energy resources used as raw materials; PERT – Total use of renewable primary energy resources; PENRE – use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM – use of non-renewable primary energy resources used as raw materials; 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.

Scenario 100% glass landfill

Table 12 Resource use for 1 m² minimal sliding insulated system M630 PHOS-Double glazing, ***scenario 100% glass landfill***

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
PERE	MJ	3,26E+02	7,27E-04	6,61E-01	1,01E-01	2,13E+00	9,07E-01	-1,07E+02
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	3,26E+02	7,27E-04	6,61E-01	1,01E-01	2,13E+00	9,07E-01	-1,07E+02
PENRE	MJ	1,15E+03	1,25E-02	1,57E+00	1,74E+00	3,95E+00	5,30E+00	-2,44E+02
PENRM	MJ	5,00E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	1,20E+03	1,25E-02	1,57E+00	1,74E+00	3,95E+00	5,30E+00	-2,44E+02
SM	kg	3,75E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	7,71E-01	6,46E-07	6,43E-04	8,96E-05	1,15E-03	8,35E-03	-2,66E-01

Note: PERE – use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM – use of renewable primary energy resources used as raw materials; PERT – Total use of renewable primary energy resources; PENRE – use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM – use of non-renewable primary energy resources used as raw materials; 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.

4.3 Result of the LCA – Output flows, waste categories minimal sliding insulated system M630 PHOS-Double glazing, 1 m^2

Scenario 100% glass recycling

Table 13 Output flows, waste categories for 1 m^2 minimal sliding insulated system M630 PHOS-Double glazing, ***scenario 100% glass recycling***

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
HWD	kg	1,42E-06	5,24E-13	3,81E-10	1,09E-10	2,64E-09	6,67E-10	-1,27E-07
NHWD	kg	1,50E+01	2,02E-06	1,03E-03	4,20E-04	1,01E-02	1,51E+00	-5,38E+00
RWD	kg	4,94E-02	1,20E-08	2,11E-04	2,50E-06	1,56E-04	9,96E-05	-1,58E-02
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,64E+01	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,97E+00	0,00E+00
EET	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,98E+00	0,00E+00

Note: HWD – hazardous waste disposed; NHWD – Non-hazardous waste disposed; RWD – Radioactive waste disposed; CRU – Components for re-use; MFR – Materials for recycling; MER – Materials for energy recovery; EEE – Exported electrical energy; EET – Exported thermal energy

Scenario 100% glass landfill

Table 14 Output flows, waste categories for 1 m^2 minimal sliding insulated system M630 PHOS-Double glazing, ***scenario 100% glass landfill***

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
HWD	kg	1,42E-06	5,24E-13	3,81E-10	7,26E-11	3,07E-09	8,57E-10	-1,26E-07
NHWD	kg	1,50E+01	2,02E-06	1,03E-03	2,80E-04	4,09E-03	1,04E+01	-5,16E+00
RWD	kg	4,94E-02	1,20E-08	2,11E-04	1,67E-06	3,72E-04	1,18E-04	-1,49E-02
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,75E+00	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,97E+00	0,00E+00
EET	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,98E+00	0,00E+00

Note: HWD – hazardous waste disposed; NHWD – Non-hazardous waste disposed; RWD – Radioactive waste disposed; CRU – Components for re-use; MFR – Materials for recycling; MER – Materials for energy recovery; EEE – Exported electrical energy; EET – Exported thermal energy

5 LCA – INTERPRETATION

The results are analysed and interpreted for modules A1-A3 and for modules C1-D. Results for module A4 are not further interpreted, as calculated only for 1 km.

Production stages: modules A1 to A3.

The biggest contributor to the environmental impacts is aluminium production which is influenced by the mass of aluminium in the declared unit: the higher the aluminium mass, the higher the indicator. The GWP indicator is 8,67 E+01 [kg CO2-eq] for M630 PHOS-Double glazing.

Within the aluminium production processes, the primary aluminium production is dominant, especially the alumina production and the electrolysis. The recycled ingot production, which presents a much lower impact than the primary ingot production, is used in Module A1-A3 for the fraction of aluminium coming from recycling. The extrusion process which converts ingot, i.e. billets, into profile is much less significant. The LCA modelling and the impact of the primary aluminium production are detailed in the Environmental Profile Report 2018.

End-of-life stage: modules C1-C4 and module D

Modules C1-C3: they are negligible for all products compared to modules A1-A3 (<1,1% for scenario 100% glass recycling and <0,6% for scenario 100% glass landfill).

Module C4: the C4 (disposal) is very limited (<3,9% for scenario 100% glass recycling and <4% for scenario 100% glass landfill) compared to modules A1-A3 and module D.

Module D: environmental benefits come from the recycling of aluminium. About 29% of GWP savings, for scenario 100% glass recycling, are obtained in Module D compared to the value calculated for module A1-A3 and about 22,6% for scenario 100% glass landfill.

6 OTHER INFORMATION

Alumil S.A is founded on the concept of corporate responsibility and includes recognition of the need for positive actions, and continuous support and development of the local communities that neighbour our facilities.

Through its Environmental Management System, certified according to ISO 14001:2015, Alumil S.A actively implements best practices regarding environmental protection through significant investments and measures, by optimizing the production cycle, implementing new procedures that reduce the energy footprint of our plants, and the vigilant prevention of any possibility of environmental pollution.

Additional information about Alumil S.A its corporate responsibility and sustainability policy and the products can be found at Alumil S.A website www.alumil.com.

These EPD results have been calculated from an LCA tool for EPD, based on the GaBi database, initially realised by thinkstep GmbH in 2013 and updated by Ecoinnovazione in 2019 (Ecoinnovazione S.r.l. – spin-off ENEA Via della Liberazione, 6/c, 40128 Bologna BO www.ecoinnovazione.it)

7 REFERENCES

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