Environmental Product Declaration of

M60 Curtain wall aluminium system by ALUMIL S.A.

In accordance with ISO 14025 & EN 15804:2012+A2:2019



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Programme related Information

Programme:	The International EPD System
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EPD based on Product Category Rules (PCR):	The CEN standard EN 15804 serves as the core Product Category Rules PCR 2019:14, version v.1.2.4 'Construction products' and c-CPR-007 'Windows and doors (EN 17213:2020)
PCR review was conducted by:	The Technical Committee of the International EPD System
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Procedure for follow-up during EPD validity involves third party verifier:	☐ Yes ☒ No
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EPD prepared by:	ENVIROMETRICS S.A. 3 Kodrou Str. Chalandri, Athens Greece www.envirometrics.gr/
CPC Code:	42120 Doors, windows and their frames and thresholds for doors, of iron, steel or aluminium

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

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

EPDs of construction products may not be comparable if they do not comply with EN 15804:2012+A2:2019. For further information about comparability, see EN 15804 and ISO 14025.

Building excellence every day

Company Information

With more than 30 years of experience and 2.200 employees, Alumil is one of the most advanced architectural aluminum systems design and manufacturing companies worldwide. At the same time, all 12 of our factories in Europe have the most modern production lines.
To achieve the extremely high degree of vertical integration, ALUMIL's industrial facilities include:

- 11 extrusion lines with a capacity of 100,000 tons
- 8 electrostatic painting lines (7 horizontal, 1 vertical)
- 3 lines of sublimation for imitation wood and special effects
- 3 anodizing facilities
- 2 aluminum billet production foundries with a capacity of 80,000 tons
- 8 heat-insulating profile assembly lines
- 1 roll forming line for aluminum leaflets
- 3 production units for the production, processing and assembly of components
- 1 unit for the production of composite aluminum sheets with a capacity of 950,000 m2
- 1 polycarbonate sheet production unit

ALUMIL's industrial premises operate:

- Multiple CNC lines, bending machines, cut-off saws, drilling machines
- Component assembly lines
- Automated packaging lines
- Polyamide and PVC extrusion lines
- Assembly line of support bases for photovoltaic systems
- Polishing machines and sandblasting lines
- Machines for the manufacture of sound curtains
- Window and door manufacturing unit

ALUMIL has created a product portfolio that incorporates innovative products and fully meets modern building needs.
The needs of our customers are particularly widened, as is our product portfolio. Each of our products is designed with one overriding thought in mind: How to deliver the best possible solution and maximize value for our customers.

- Opening systems for doors & windows
- Sliding systems for doors & windows
- Shutters & roller shutter systems
- Systems for folding doors
- Entrance doors
- Fireproof doors & heavy-duty doors
- Glass curtains & facades of buildings
- Interior dividers
- Shading systems
- Facade cladding systems
- Systems for patios & greenhouses
- Customized systems for windows and curtain walls or facades

The company is certified with the following production certifications:

- Energy Management System ISO 50001:2011
- Quality Management System ISO 9001
- Factory Production Control EN ISO 15088
- Environmental Management System ISO 14001:2015
- ISO 45001:2008 Occupational Health and Safety Management System
- QUALICOAT & GSB International certification for the quality of powder coating
- QUALANOD certification for the quality of anodizing of profiles

Product Information

This is a specific EPD and covers M60 curtain wall aluminium window manufactured by ALUMIL S.A. **Curtain Wall M60** is a modern façade system that successfully combines functionality and high aesthetics. Its design render M60 ideal for constructions in areas with high wind load where other CW systems cannot be used.

Thanks to stronger aluminium profiles and larger glass rebates, big glass panes can be easily fabricated with safety offering, at the same time, maximum transparency.

Moreover, thanks to 60mm width of profiles, M60 can meet even most demanding specs regarding interstorey drifts offering high anti seismic protection.



Technical specifications and the standards that are certified with are presented below. Overall dimensions (W x H) are 3,96m x 6,20m.

Technical Specifications	***Value***	***Source***
Air tightness	*Class AE*	*EN 12152:2002-02*
Water tightness	*Class RE 1200*	*EN 12154:1999-12*
Wind load resistance	*2000 Pa Design load* *3000 Pa Safety load*	*EN 13116:2001-07*
Impact resistance	*Class I5/E5*	*EN 14019:2016-06*

Content declaration per 1 m² of M60 system by ALUMIL S.A are presented below.

Components	Mass (kg)
Aluminium	***11,39***
Anodized aluminium profile	*11,39*
IGU	***33,08***
Flat glass	*33,08*
Gasket and fittings	***1,45***
Polyamide	*0,02*
PVC	*0,42*
EPDM Rubber	*0,78*
Stainless steel	*0,12*
Aluminium butyl tape	*0,10*
Total	***45,92***

Aluminium fed in in the smelter for the production of billets contains 60% scrap and 40% primary aluminium in the form of T-bars.

According to the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) Regulation, the product does not contain any substance included in the Candidate List of Substances of Very High Concern (SVHCs) for authorization with concentrations higher than 0.1% weight by weight (w/w).

LCA Information

Declared unit

1 m² of M60 curtain wall aluminium window as stated in EN 17213:2020.

Cut-off

The cut-off criteria adopted is as stated in *"EN 15804:2012+A2:2019".* The cut-off rule was applied in some wastes, such as electronic equipment, lamps, cables, batteries and packaging material wastes. Total mass of the excluded flows accounts for approximately 0,2%.

Time representativeness

Data for year 2021 were used

Software used

OpenLCA v.10.3 was used.

Goal and Scope

This EPD assesses environmental impacts of the production of 1 m² of M60 curtain wall aluminium window from Cradle-to-gate (modules A1-A3) with modules C and D.

Geographical scope

Worldwide

Data quality

ISO 14044 was applied in terms of data collection and quality requirements. The impact of the production of raw materials recovered from Ecoinvent database v.3.8. The data concerning the modules A2 (Transportation) and A3 (Product manufacturing) were provided by **ALUMIL S.A** and concerns the full year 2021. These data were the quantities of all input and output materials extracted from the company's ERP system, the consumed utilities (energy, water) from invoices and measuring instruments, the quantities of wastes extracted from the electronic waste register and the distances and means of transport for each input stream from purchase invoices and Google maps. Regarding electricity mix, the latest (2021) national residual electricity mix as published in DAPEEP SA was utilized. The emission factor for natural gas is provided from National Inventory Report of 2021 for Greece. The end-of-life are based on the most representative scenarios for this product. Background data for this stage are retrieved from Ecoinvent v.3.8.

System Boundary

The type of EPD is cradle to gate (modules A1-A3) with modules C1-C4 and module D.

Assumptions

Module A2: a EURO5 lorry 16-32 metric ton was utilized for road transportation and container ship, freight for sea transportation. Also, for transportation of glass used in M60 a conservative assumption of 100 km is made, since there were no available transportation data for this raw material.

Module C1: the specific diesel consumption for a building demolition is considered as 0,239 MJ/kg product of material according to JRC TECHNICAL REPORT *''Model for Life Cycle Assessment (LCA) of buildings''*.

Module C2: a conservative assumption of 100 km by lorry 16-32 metric ton was used.

Module C3 and C4: The scenarios included are currently in use and are representative for one of the most probable alternatives.

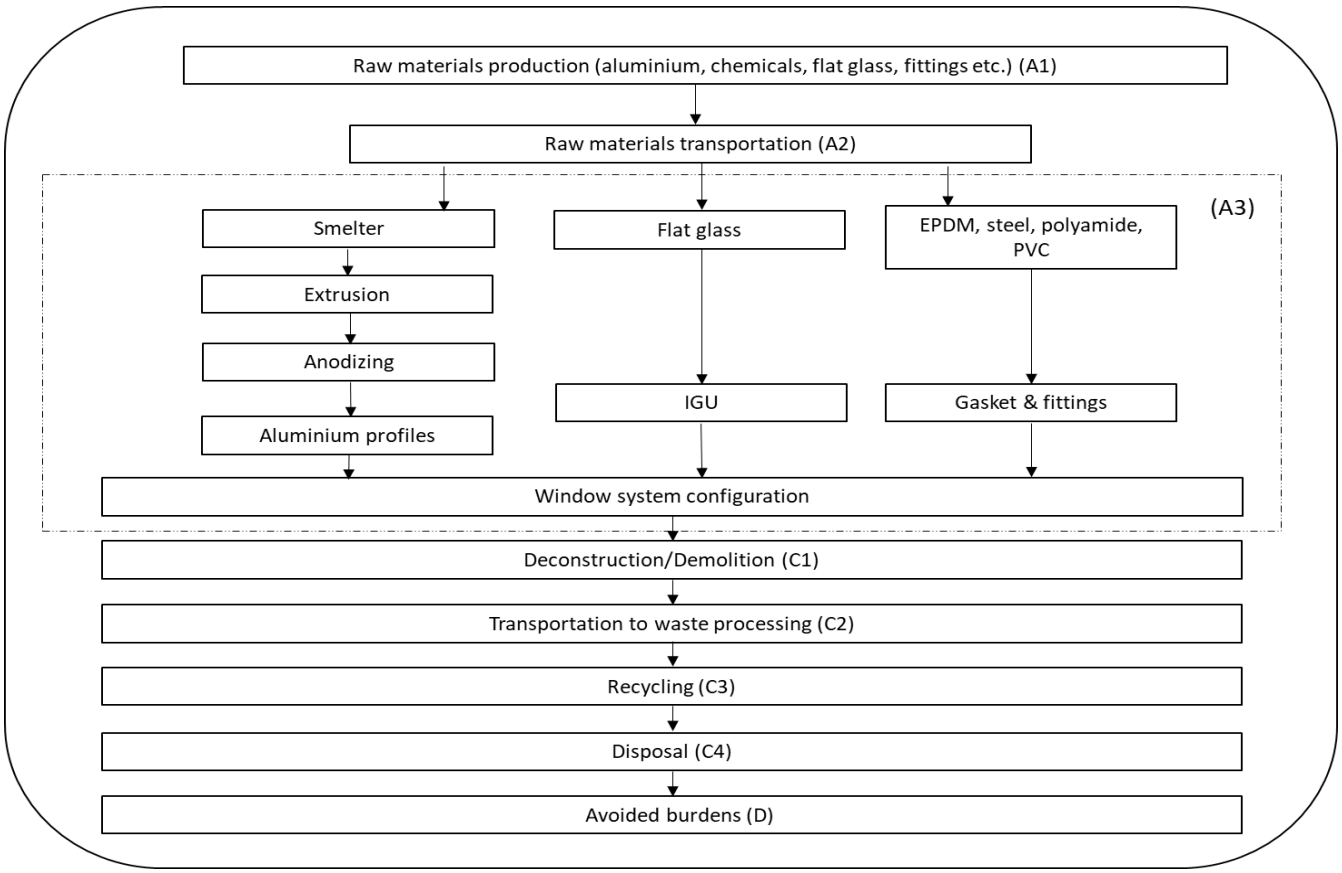
End-of-life scenarios regarding the recycling and disposal rates of all components of the final product are obtained from EN 17213:2020 '*Windows and doors*'. According to this standard, the recycling rate of all non-glass materials (aluminium profile and other fittings and gaskets such as EPDM, steel, PVC, polyamide) is assumed to be 95%, while the recycling rate for flat glass included in the final product is 30%.

This means that 5% of non-glass materials and 70% of glass unit included in the final product are going to be disposed.

Allocations

Allocation rules have been performed in accordance with the requirements of ISO 14044:2006. Mass allocation is applied to all wastes generated through the manufacturing process and in all streams in anodizing stage, since two semi-finished products are manufactured in this stage (extruded anodized and thermal break anodized profiles), but only extruded anodized profile is used for the product under the scope of this EPD. Furthermore, it should be noted that environmental impacts from untreated aluminium scrap used in the smelter are not taken into account, according to ''polluter pays principal'', as stated in EN 15804:2012+A2:2019.

Flow diagram



System boundaries

	Product stage			Construction stage		Use stage							End-of-life stage				Resource recovery stage
	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 for reuse, recovery and/or recycling**	**Disposal**	**Reuse-Recovery-Recycling-potential**
Modules	**A1**	**A2**	**A3**	A4	A5	B1	B2	B3	B4	B5	B6	B7	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X
Geography	**GLO**	**GLO**	**GR**										**EU**	**EU**	**EU**	**EU**	**EU**
Specific data used	**>90%**												-	-	-	-	-
Variation-products	**Not relevant**												-	-	-	-	-
Variation-sites	**Not relevant**												-	-	-	-	-

Modules of LCA analysis: X = module declared, MND = Module Not Declared

A1: Raw Material Supply

The production starts with the material supply. This module includes the mining and pretreatment processes before production (processing of raw materials, generation of electricity and fuels required for the manufacturing, recycling process of secondary materials). Primary aluminium and aluminium scrap are the main raw materials charged in the smelter. In the extrusion line, primary aluminium billets and billets derived from smelter are the main raw materials fed. Moreover, the usage of chemicals is required regarding the anodizing of extruded profiles. For the production of M60 aluminium window system, except from anodized aluminium profiles, other raw materials such as polyamide, PVC, EPDM, stainless steel and insulated glass unit (IGU) are used.

A2: Transportation of raw materials to manufacturer

Transportation is relevant to delivery of raw materials from the supplier to the gate of manufacturing plant. Aluminium billets and other raw materials are transported to the manufacturing site from Greece and other countries, all over the world. Trucks and vessels for sea transportation are the main transportation means.

A3: Manufacturing

The manufacturing process starts with the smelting of aluminium, where primary aluminium alloys and aluminium scrap are fed into ALUMIL's smelters. Imported aluminium billets and billets derived from ALUMIL's smelters are driven to the extrusion line, in which aluminum is forced to flow through a shaped opening in the die in order to be moulded into aluminum profiles. Afterwards, some of the extruded profiles undergo an anodizing process, where aluminium is immersed into an acid electrolyte bath and passes through an electric current through the medium. Finally, anodized aluminium profiles along with glass and other fittings are used for the configuration of M60 curtain wall aluminium system. It should be noted that, since curtain wall fabrication is not performed by ALUMIL but by their distributors disseminated in Europe who sell and install ALUMIL curtain wall systems on the European market, impacts from the electricity or fuels needed for the assembly are not taken into account.

C1: De-construction and demolition

The deconstruction and demolition of the product takes place with the demolition of the building or other construction.

C2: Transportation to waste processing

Transportation of the discarded product either to the recycling site or to landfills for final disposal. As a conservative assumption, a distance of 100 km transportation to waste processing sites is assumed.

C3: Waste processing for reuse, recovery and/or recycling

Aluminium waste collected from the deconstruction site are separated from the other waste in order to be recycled and used in a new product system. According to *EN 17213:2020*, recycling rate for non-glass materials in the final product (aluminium, plastics and other gaskets and fittings) is 95%, while for insulating glass unit (IGU), the recycling rate is 30%.

C4: Disposal

Usually, a small amount of the waste is remaining either in the deconstruction site or in the separation. This small portion will be landfilled. In relation to the C3 stage explained above, 5% of non-glass materials are assumed to be landfilled, while IGU has a landfill rate of 70%.

D: Reuse-Recovery-Recycling-potential

Module D consists of avoided burdens related to the potential reuse and/or recycling of the product after its end-of-life stage. The reuse/recycling rates of all components of the final product are referred above, while the recycled content of aluminium in the feed is 60%.

Environmental performance of M60 Curtain wall

Environmental impacts

	Unit	A1-A3	C1	C2	C3	C4	D
GWP-total	kg CO2 eq	1,40E+02	1,01E+00	7,64E-01	5,50E-01	3,65E-01	-4,16E+01
GWP-fossil	kg CO2 eq	1,39E+02	1,01E+00	7,63E-01	5,15E-01	3,20E-01	-4,14E+01
GWP-biogenic	kg CO2 eq	8,54E-01	1,64E-04	2,69E-04	3,43E-02	4,45E-02	-1,21E-01
GWP-luluc	kg CO2 eq	6,97E-01	1,01E-04	3,00E-04	4,20E-04	2,37E-04	-7,96E-02
GWP-GHG[1]	kg CO2 eq	1,36E+02	9,98E-01	7,56E-01	5,10E-01	3,34E-01	-4,03E+01
ODP	kg CFC-11 eq	1,77E-05	2,16E-07	1,77E-07	5,87E-08	8,02E-08	-3,01E-06
AP	mol H+ eq	8,90E-01	1,05E-02	3,10E-03	1,88E-03	2,42E-03	-2,97E-01
EP-freshwater	kg PO4-3 eq	1,73E-01	9,58E-05	1,51E-04	1,56E-04	9,17E-05	-4,18E-02
EP-freshwater	kg P eq	5,65E-02	3,13E-05	4,92E-05	5,10E-05	2,99E-05	-1,36E-02
EP-marine	kg N eq	1,42E-01	4,64E-03	9,33E-04	3,11E-03	1,01E-03	-4,70E-02
EP-terrestrial	mol N eq	1,51E+00	5,09E-02	1,02E-02	6,95E-03	9,63E-03	-5,41E-01
POCP	kg NMVOC eq	4,40E-01	1,40E-02	3,12E-03	2,16E-03	3,73E-03	-1,59E-01
ADPe	kg Sb eq	9,53E-04	5,19E-07	2,65E-06	1,09E-06	8,28E-07	-5,21E-04
ADPf	MJ	1,94E+03	1,38E+01	1,15E+01	4,84E+00	5,97E+00	-5,15E+02
WDP[2]	m3 eq	1,40E+02	3,39E-02	5,52E-02	-1,33E-02	2,51E-01	-1,54E+01

[1] GWP-GHG indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide emissions and uptake and biogenic carbon stored in the product, with characterization factors (CFs) based on IPCC (2013).

[2]The results of this environmental impact indicators of ADPf, ADPe and WDP shall be used with care as the uncertainties of these results are high or as there is limited experienced with the indicator.

Resource use

	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	2,73E+02	7,78E-02	1,63E-01	1,50E-01	8,73E-02	-4,58E+01
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	2,73E+02	7,78E-02	1,63E-01	1,50E-01	8,73E-02	-4,58E+01
PENRE	MJ	1,94E+03	1,38E+01	1,15E+01	4,85E+00	5,97E+00	-5,15E+02
PENRM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	1,94E+03	1,38E+01	1,15E+01	4,85E+00	5,97E+00	-5,15E+02
SM	kg	6,97E+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
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m3	2,04E+00	7,90E-04	1,29E-03	-3,11E-04	5,84E-03	-3,59E-01

Output flows and waste categories

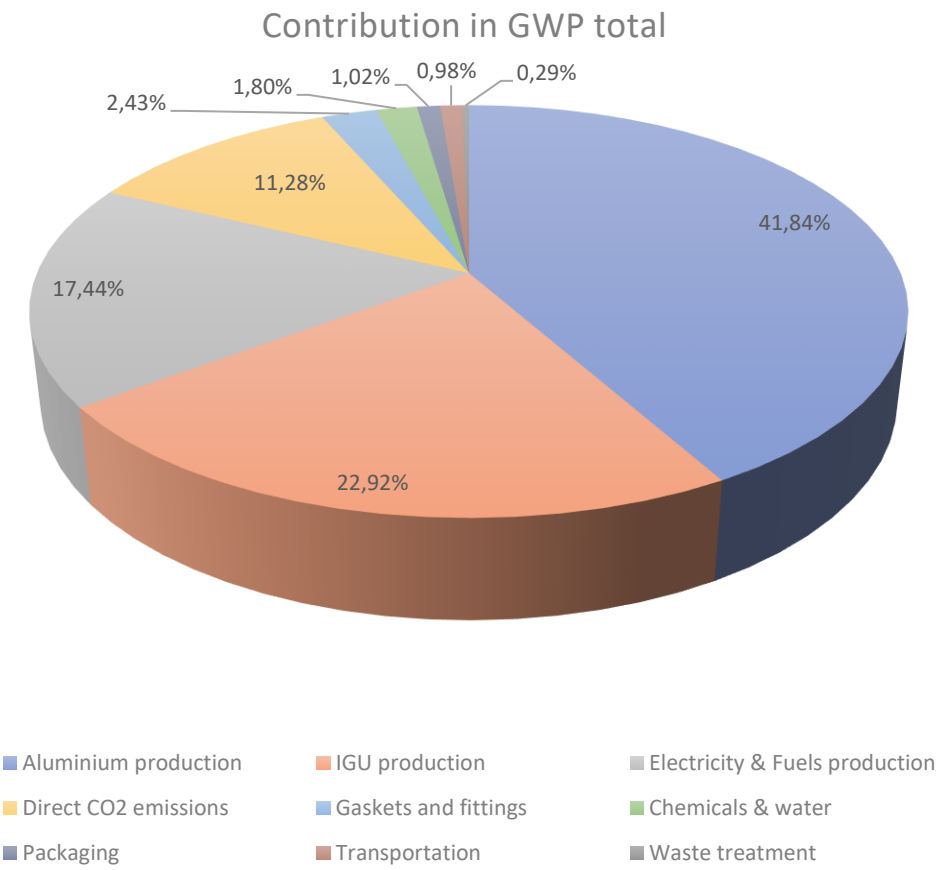
	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	1,34E-02	3,79E-05	3,01E-05	1,04E-05	9,93E-06	-1,02E-02
NHWD	kg	2,13E+01	1,88E-02	5,94E-01	1,10E+01	2,29E+01	-9,88E-01
RWD	kg	7,57E-03	9,56E-05	7,80E-05	2,88E-05	3,65E-05	-1,61E-03
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	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
EE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Additional impacts

	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidence	1,10E-05	2,78E-07	5,30E-08	8,49E-08	4,41E-08	-5,50E-06
IRP[3]	kBq U235 eq	2,07E+01	6,24E-02	5,93E-02	3,00E-02	2,67E-02	-3,38E+00
ETP-FW	CTUe	2,24E+03	7,87E+00	8,67E+00	9,42E+01	3,62E+02	-9,07E+02
HTP-c	CTUh	1,93E-07	3,13E-10	2,90E-10	1,28E-09	9,91E-09	-6,21E-08
HTP-nc	CTUh	2,54E-06	5,88E-09	9,47E-09	1,17E-08	2,74E-08	-7,92E-07
SQP	dimensionless	2,68E+02	1,67E+00	7,74E+00	2,99E+00	6,39E+00	-7,80E+01

[3] Ionizing radiation potential (IRP) 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.

Interpretation



As it is presented above, aluminium production contributes the most for the production of M60, accounting for 42,27%. Production of insulated glass unit is responsible for 23,16% of the total global warming impact while energy sources production and transmission (natural gas, diesel and mainly electricity) contributes 17,62%. On-site emissions from natural gas and diesel combustion add up 11,39%. Other factors such as gasket and fittings production, chemicals for anodizing, packaging, transportation of raw materials and waste treatment are of minor importance with 2,46%, 1,82%, 1,02%, 0,99% and 0,29% respectively.

Additional Information

The EPD does not give information on release of dangerous substances to soil, water and indoor air because the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonized test methods according to the provisions of the respective technical committees for European product standards are not available.

List of abbreviations

LCA	Life Cycle assessment
EPD	Environmental Product Declaration
PCR	Product category rules
GLO	Global
RER	Europe
RoW	Rest of the world
GWP-total	Global Warming Potential total
GWP-fossil	Global Warming Potential fossil
GWP-biogenic	Global Warming Potential biogenic
GWP-luluc	Global Warming Potential land use and land use change
ODP	Ozone Depletion Potential
AP	Acidification Potential
EP-freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment
EP-marine	Eutrophication Potential fraction of nutrients reaching marine end compartment
EP- terrestrial	Eutrophication potential, Accumulated Exceedance
POCP	Formation potential of tropospheric ozone photochemical oxidants
ADPe	Abiotic depletion potential for non-fossil resources
ADPf	Abiotic depletion potential for fossil resources
WDP	Water use
PERE	Use of renewable primary energy excluding 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 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 material
RSF	Use of renewable secondary fuels
NRSF	Use of non-renewable secondary fuels
FW	Use of net fresh water
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
EE	Exported Energy
PM	Particulate matter emissions
IRP	Ionizing radiation, human health
ETP-FW	Ecotoxicity, freshwater

HTP-c	Human toxicity, cancer
HTP-nc	Human toxicity, non-cancer
SQP	Land use related impacts/Soil quality

References

- ***General Programme Instructions*** *for the International EPD® System. Version 4.0, 2021-03-29*
- ***PCR 2019:14*** v.1.2.4 Construction products. EPD System. Date 2022-09-07. Valid until 2024-12-20
- ***EN 15804:2012+A2:2019/AC,*** *Sustainability of construction works - Environmental Product Declarations — Core rules for the product category of construction products*
- ***C-PCR-007*** *Windows and doors. Date 2020-04-09*
- ***ISO 14020:2000*** *Environmental labels and declarations — General principles*
- ***ISO 14025:2006*** *Environmental labels and declarations - Type III environmental declarations — Principles and procedures*
- ***ISO 14040:2006*** *Environmental management - Life cycle assessment-Principles and framework*
- ***ISO 14044:2006*** *Environmental management - Life cycle assessment - Requirements and guidelines*
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- ***ENVIRONMENTALPROFILE REPORT****-Life-Cycle inventory data for aluminium production and transformation processes in Europe, European Aluminium Association, February 2018*
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