



ENVIRONMENTAL PRODUCT DECLARATION



PROGRAMME

The International EPD® System, www.environdec.com
EPD® Turkey, www.epdturkey.org

PROGRAMME OPERATOR

EPD® International AB & EPD Turkey

EPD REGISTRATION NUMBER

S-P-04802

VALID UNTIL

2027-06-20

PUBLICATION DATE

2022-06-21

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at: www.environdec.com

A2 Aluminium
Composite
Panels

Programme Information

Programme Information

Programme: The International EPD® System

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Information about verification and reference PCR:

CEN standard EN 15804 serves as the Core Product Category Rules (PCR)

Product category rules (PCR)

PCR 2019:14 Construction products (EN 15804:A2) Version 1.1

PCR review was conducted by

The Technical Committee of the International EPD® System. See www.environdec.com/TC for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.

Independent verification of the declaration and data, according to ISO 14025:2006:

☐

EPD process verification



EPD verification

Third party verifier

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Approved by

The International EPD® System Technical Committee, supported by the Secretariat

Procedure for follow-up of data during EPD validity involves third party verifier:

☐

Yes



No

LCA Study & EPD Design Conducted by

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ASAŞ Alüminyum Sanayi ve Ticaret A.Ş. 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. For further information about comparability, see EN 15804 and ISO 14025.

Company Information

Owner of the EPD

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Based on its stable financial growth trend since its establishment in 1990, ASAŞ is one of the leading manufacturers in Europe and exports to more than 90 countries across 6 continents. With over 3000 employees, ASAŞ provides services for its clients at its Aluminium Extrusion Profile, Aluminium Composite Panel, Aluminium Flat Rolled Products, PVC Profile and Roller Shutter production facilities which are located in a total of 923.000 m² area, of which 300.000 m² is enclosed, in Turkey. Company offers the advantage of keeping all processes under control both in terms of quality & cost and getting service from a single point with its fully integrated manufacturing facilities which combines all the production functions that customers needed in the supply chain. ASAS GmbH, sub company of ASAŞ, serves as a logistics and service center with 72.793m² closed area in neighboring Koblenz city of Neuwied, Germany.

Passion of “Adding Value” to every job it does, the sector and the society in which it operates and sustainability is at the heart of ASAŞ’s business philosophy. Corporate social responsibility projects are carried out with this philosophy to strengthen the society. ASAŞART, which is positioned as an “Art Production Center, operates as a learning+ sharing+ designing+ production platform that brings art and design students together with academics and professionals. Within ASAŞART, special projects are developed to support young talents in their art carrier; aluminium sculpture contest, training programs with universities, international workshops and art exhibitions are organized. Children are at the center of ASAS’ corporate social responsibility projects. Company established ASAS Basketball Club so as to support children to be successful individuals in the future with sports as well as social and educational activities.

ASAŞ positions itself as a solution partner with a passion of trying to foresee the future trends by following the innovations and always offering the best for its customers by investing in technology. Therefore, while making investments company adopts the principles of “continuous investment in sustainability, technology, integration and innovation” to always serve its customers better. With this perspective, company established the first R & D Center in aluminium sector in Turkey. Alloy development, process development and product development studies are carried out under the umbrella of R&D Center. Company develops projects to use its resources more efficiently and grows with environment friendly investments. Besides these, ASAŞ takes part in international projects to contribute the development of new processes that helps to minimize the environmental impact of the production processes and increase the energy efficiency.



ASAŞ produces wide range of value-added products for various sectors like automotive, railway, commercial vehicles, energy, packaging, construction, consumer products, maritime etc. worldwide. Finished and semi-finished products are produced to meet its customers’ needs in their own projects. Besides this, the company enrich its knowledge in the field of production with design & product development studies and offers its high-quality products to the market under its own brands. Aluminium architectural systems (door, window, and curtain wall systems), aluminium composite panels, u-PVC door and window systems, aluminium design products (aluminium flag and lighting poles, aluminium furniture etc.), roller shutter systems, garage doors and motor control systems are product groups that the company sells with its own brand.

Product Information

Product Name:

A2 Aluminium Composite Panel

Aluminium composite panels, also called as ACPs, ACP is an external building cladding material used to create great-looking and durable facades. It consists of two thin powder coated aluminium sheets bonded to a non-aluminium core. A core can be made of an aluminium, mineral, or a thermoplastic polymer, provide bonding of two powder coated aluminium sheets. Aluminium composite panels has been used in facade cladding for the construction sector because of their light weight and strength, enriching living quarters with internal and external cladding and other special design and production solutions. It provides a wide range of application choices to designer, especially for skyscrapers, custom design modern architectural buildings and airports. It's great versatility allows the panel to be used as a combination with other materials to cover certain areas of a facade or as the main element in complicated transformations.

Since the aluminium composite panel began its journey in the construction sector, its characteristics have been improving until it has become a highly modifiable product, which admits different forms of assembly, colours, transformations and uses. The used material is economical when it is compared with other choices. The other advantage is that ACP is resistant in terms of stain, UV, chemical, weather, termite, and fungi. Aluminium composite panels require significantly less maintenance than other similar products (such as FC Sheet) due to its PVDF coating and finish. The core material and cover sheets of aluminium composite panel can be recycled and reused. Due to its characteristics, aluminium can be recycled indefinitely.

Intended Use of Product

ASAŞ aluminium composite panel products; while providing solutions on facade cladding systems for the construction industry, adds value to living spaces with design and production solutions for industrial and architectural interior - exterior cladding and other special applications.

Composite panels produced within ASAŞ; is assured in quality with high quality PVDF painted aluminium sheet and LDPE resin in accordance with TS EN 13501 standard.

Aluminium composite panels with aluminum hydroxide filling have LDPE and AL(OH) filling material. In the case of the A2 panel, this is a non-combustible panel composed of a mineral core developed to meet the highest regulatory requirements of fire classification. Aluminium hydroxide core panels reaction to a fire classification A2-s1, d0 (according to UNE EN 13501-1:2007), makes it the ideal cladding solution for high-rise buildings and high occupancy.

Production

In the cold rolled production plant, the process starts with induction and casting. Cast rolled aluminium is produced by mixing primary aluminium, secondary aluminium, and pre-consumer recycled materials with other additives in the casting process. After the casting process, aluminium alloys are treated in cold rolling, plate annealing, plate stretching and dyeing and cutting processes.

After the cutting process is completed, the flat rolled aluminium sheet is ready and internally transported to ASAŞ Akyazı plant, to be utilized in aluminium composite panel production or in other production lines for different purposes.

In composite panel facility plant, the process consists of three stages:

- Mixer: Core filling material is prepared
- Extruder&lamination: Core filling material is extruded between to aluminium sheets, protective band is applied on one side of panel.
- Cooling&cutting: The composite panel is cooled for drying and setting of filling, and afterwards cut in desirable measurements.



Technical Specifications

UN CPC Code : 4299 – fabricated metal products-Other fabricated metal.

Product	Standarts	Description
Painted Aluminium Sheet	TS EN 9260 ISO 4628-2	Paints and varnishes - Evaluation of degradation of coatings; Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Part 2: Assessment of degree of blistering
	DS EN ISO 4628-3	Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Part 3: Assessment of degree of rusting
	DS EN ISO 4628-4	Paints and varnishes - Evaluation of degradation of coatings; Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Part 4: Assessment of degree of cracking
	DS EN ISO 4628-10	Paints and varnishes. Evaluation of degradation of coatings. Designation of quantity and size of defects, and of intensity of uniform changes in appearance Assessment of degree of filiform corrosion.
	TS EN ISO 1520	Paints and varnishes - Cupping test
	TS EN ISO 6270-1	Paints and varnishes - Determination of resistance to humidity - Part 1: Condensation (single-sided exposure)
	DIN EN ISO 2808	Paint and Varnishes -Determination of film thickness
	DIN EN ISO 2808	Paint and Varnishes -Determination of film thickness
	DS/EN ISO 2409	Paint and Varnishes -Cross cut test
	ISO 3251	Paints, varnishes and plastics - Determination of non-volatile-matter content
	ISO 1519	Paints and varnishes - Bend test (cylindrical mandrel)
	ASTM D 4214-07	Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films

Technical Specifications

UN CPC Code : 4299 – fabricated metal products-Other fabricated metal.

Product	Standarts	Description
Aluminium Composite Panels	TS EN 822*	Thermal insulating products for building applications determination of length and width
	TS EN 823*	Thermal insulating products for building applications-Determination of thickness
	TS EN 824*	Thermal insulating products for building applications-Determination of squareness
	TS EN 1464*	Adhesives - Determination of peel resistance of adhesive bonds - Floating roller method
	TS EN 13495	Thermal insulation products for building applications - Determination of the pull-off resistance of external thermal insulation composite systems (ETICS) (foam block test)
	TS EN 13497	Thermal insulation products for building applications - Determination of the resistance to impact of external thermal insulation composite systems (ETICS)
	TS EN 13501-1*	Fire classification of construction products and building elements-Part 1: Classification using test data from reaction to fire tests.
	TS EN 15715*	Thermal insulation products - Instructions for mounting and fixing for reaction to fire testing - Factory made products
	TS EN ISO 9229	Thermal insulation - Vocabulary
	TS EN ISO 354	Acoustics - Measurement of sound absorption in a reverberation room
	TS EN ISO 2409*	Paints and varnishes - Cross-cut test
	TS EN ISO 2808	Paints and varnishes - Determination of film thickness
	TS EN ISO 2813*	Paints andvarnishes - Determination of specular gloos of non-metallic paint films at 20, 60 and 85
	TS EN ISO 11654	Acoustics-Sound absorbers for use in buildings-Rating of sound absorption
	TS ISO 2859-1	Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection

LCA Information

1 m² of A2 Aluminium Composite Panels manufactured in Akyazi facilitate (TR).

Reference Service Life

Not applicable.

Time Representativeness

The inventory for the LCA study is based on the period of 1st January 2021 and 30st June 2021

Database(s) and LCA software used

SimaPro LCA v9.2.0.2 software with Ecoinvent v3.7.1

Description of System Boundaries

Cradle to gate with options, modules, C1-C4, D (A1–A3 + C + D)

Data Quality and Data Collection

According to EN 15804:2012+A2:2019 specific data was used for module A3 (Processes the manufacturer has influence over) and was gathered from the manufacturing plant. Specific data includes actual product weights, amounts of raw materials used, product content, energy consumption, transport figures, water consumption and amounts of wastes.

ASAŞ handles its industrial production operations in two facilities. The facilities are established in Akyazi and Karapürçek; both in Turkey, Sakarya province.

The raw material, painted aluminium sheets, is manufactured in ASAŞ Sakarya premises. The product is internally transported to ASAŞ Akyazi premises to be utilized in aluminium composite panel manufacture and in other domains compatible with Akyazi facility manufacture capabilities.

The manufacturing data (specific), specific energy and chemical consumption values and raw materials/chemicals are collected and monitored and recorded by ASAŞ responsible from people

For A1 and A2 modules, According to EN 15804:2012+A2:2019, generic data was applied and was obtained from Ecoinvent v3.7.1. Data collection for this LCA study has been carried out in accordance with data requirement stated in ISO 14040-44, ISO 14025, ISO 14020, and the requirements given in the General Program Instructions v3.01; PCR Construction products 2019:14, version 1.11 by The International EPD® System and EN 15804:2012+A2:2019.

Specific data used in this LCA study is less than 1 year old. Generic data used in the study was obtained from Ecoinvent v3.7.1 which is less than 10 years old.

Cut-off criteria for the upstream generic data is at least 99%, according to the General Programme Requirement in terms of the energy, the mass, and the overall environmental relevance of the flows. Inventory data covers all elementary flows and are obtained from Ecoinvent v3.7.1.

Allocation

Waste and packaging data are allocated to cold rolled aluminium sheet, painted aluminium sheet and aluminium foil, taking into account the total amount in the relevant time period.

Energy data was subjected to allocation, according to total electric production through trigeneration facility within ASAŞ Akyazi, and total electric consumption from Turkey grid, hydropower mix.

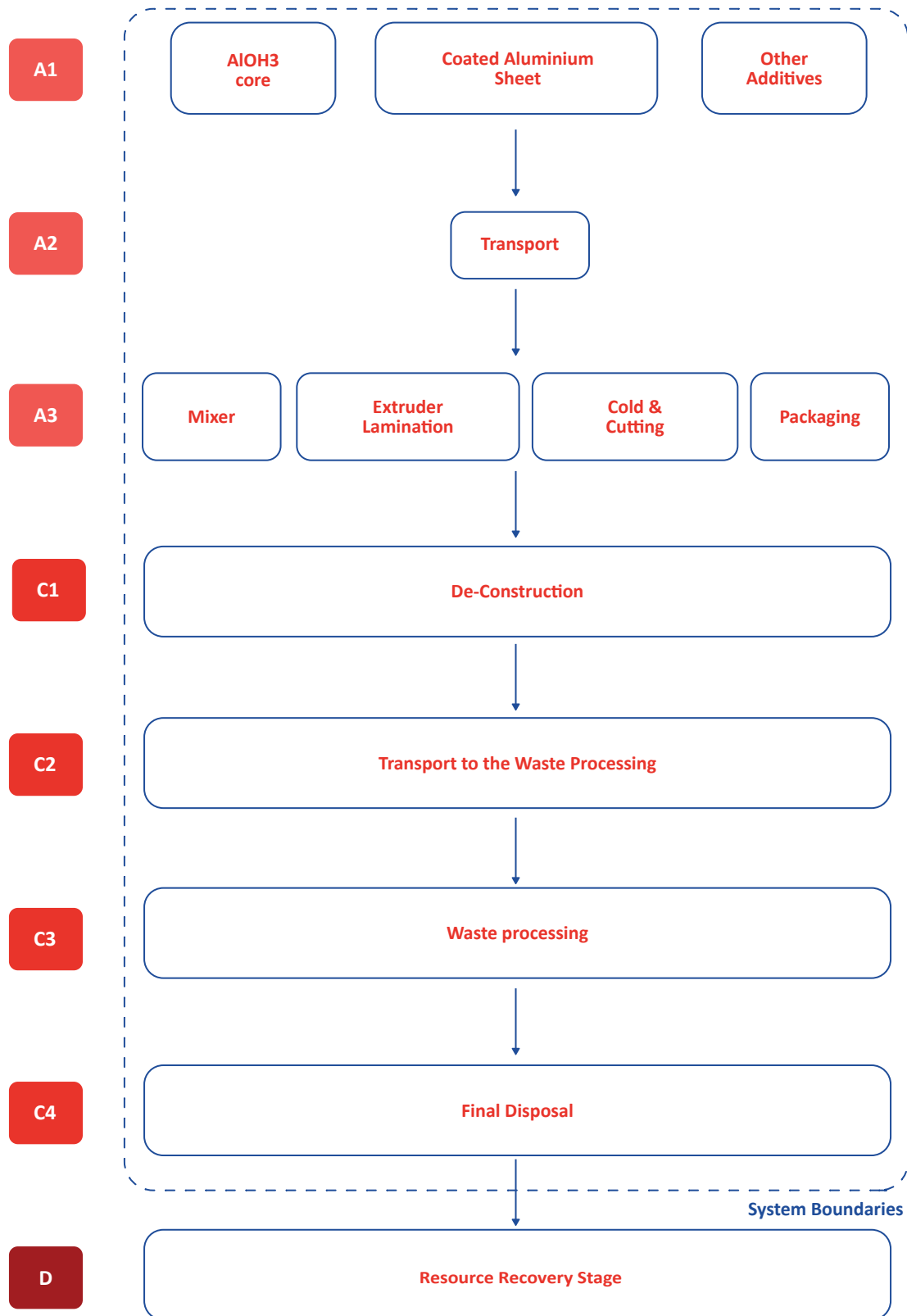
Cut-off Rules

Life Cycle Inventory data for a minimum of 99 % of total inflows to the three life cycle stages have been included and a cut-off rule of 1% regarding energy, mass, and environmental relevance was applied.

Modules declared, geographical scope, share of specific data (in GWP-GHG indicator) and data variation

	PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				RESOURCE RECOVERY STAGE
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Recycling Potential
MODULES	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Module declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	GLO	GLO	TR	-	-	-	-	-	-	-	-	-	GLO	GLO	GLO	GLO	GLO
Specific data used	>99%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation-products	Not Relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation-sites	Not Relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-

System Diagram



Description of Declared Modules

A1 - Raw Materials Supply

This module takes into account raw material extraction, processing and energy used in the production process.

A2 - Transport to the Manufacturer

This module includes transportation of the raw materials from supplier to factory gate. Transportation types are considered as seaway and roadway.

A3 - Manufacturing

This stage includes energy and water consumption during the manufacturing process. Additionally, packaging materials are covered in this module. The processing of any waste arising from this stage is also included. Product manufacture process can be categorized into 3 steps. First, painted aluminium sheet is produced within ASAS. Followed manufacture sub-processes for the painted aluminium sheet, which will qualify as a raw material in the aluminium composite panel production line, are as following:

- Induction
- Casting
- Cold Rolling
- Annealing
- Cutting

The proceeding step is production of mineral core in the mixer; and lastly, a sheet of the material that will make up the core is extruded and compacted between two aluminium sheets that are unwound at the same time. Finally, the flatness of the material is compacted and perfected and a protective film is applied.

C1 - De-construction

In module C1, it is assumed that demolition of the panel from base construction material is done manually. Given the scenario that is assumed, environmental impact of de-construction process is not considered in this study.

C2 - Transport to Waste Processing

An average distance of 100 km has been assumed for the transport to sorting facility. Transport is calculated on the basis of a scenario with the parameters described in the attached table.

Parameters C2 Module	
Transport by road*	Lorry, 16-32 metric ton
Distance (km)	100
Database	Ecoinvent v3.7.1

*Technology is Euro 6

C3 - Waste Processing for Reuse, Recovery and/or Recycling

This module includes the energy consumption required for recycling aluminium materials that could be stripped away from the panel core. The stripping process was assumed to be 90% efficient. 90% of aluminium constituent of panel can be subjected to recycling processes.

C4 - Final Disposal

The inseparable portion and the separated panel core of the final product is considered to be sent to landfill.

D - Reuse, Recovery or Recycling Potential

Aluminium composite panel inputs to the production stage are subtracted from the construction to be recycled at end-of-life in order to obtain the panel from the product system. This remaining panel is then sent to recycling. Module D reports the environmental aspects of recycled scrap generated at the end of life minus that used at the production stage.

Information on which life cycle stages are not considered

This EPD only cover the Cradle to Gate with options A1-3 and C1-4 and D stages because other stages are very dependent on particular scenarios and are better developed for specific building or construction works.



Functional Unit

	Name	Value	Unit
Aluminium hydroxide core panel, A2 flammability	Functional Unit	1	m²
	Grammage	8.5	kg/m2
	Conversion factor to 1 kg	0.118	

Content Declaration

Content Declaration by mass%, 1m² B2 Panel

Product	Filling material, weight%	Primer Aluminium, weight%	Post-consumer recycled material, weight%	Internal Scrap, weight%	Additives, weight%	Colourant, weight%	Post-consumer material, weight%	Renewable material, weight-%	Biogenic carbon, kg
Aluminium hydroxide core composite panel	70 - 80	10 - 15	< 5	< 5	< 0.5	< 3.5	20-25	0	0

Packaging Declaration by mass% (versus the product)

Aluminium hydroxide core composite panel	Weight, %	Biogenic carbon, kg C
LDPE	0.92	-
Wood	2.06	0.223

Disclaimer: There are no SVHC compounds in the products which is declared in the report.



Environmental Performance

Potential Environmental Impact *Mandatory Indicators According to EN 15804+A2*

Results for 1m2 of A2 Aluminium Composite Panels							
Indicator	Unit	A1-3 Total	C1	C2	C3	C4	D
GWP-fossil	kg CO ₂ eq	37.5	0	0.144	0.006	0.144	-16.0
GWP - biogenic	kg CO ₂ eq	-0.313	0	2.80E-04	2.48E-04	0.001	0.037
GWP-luluc	kg CO ₂ eq	0.247	0	5.23E-05	8.89E-06	2.74E-05	-0.160
GWP-total	kg CO ₂ eq	37.5	0	0.145	0.006	0.145	-16.2
ODP	kg CFC 11eq	2.14E-06	0	3.13E-08	5.60E-10	1.29E-08	-7.04E-07
AP	mol H+ eq	0.279	0	4.20E-04	3.95E-05	3.98E-04	-0.113
EP-Freshwater	kg PO ₄ ³⁻ eq	0.020	0	4.43E-05	5.14E-06	6.16E-05	-0.008
EP-aquatic fresh-water	kg P eq	0.002	0	1.27E-06	4.54E-07	9.07E-07	-0.001
EP-marine	kg N eq	0.042	0	8.51E-05	1.05E-05	1.50E-04	-0.015
EP-Terrestrial	kg N eq	0.470	0	9.47E-04	1.16E-04	1.47E-03	-0.172
POCP	kg NMVOC eq	0.140	0	3.53E-04	3.19E-05	4.43E-04	-0.052
ADP-minerals & metals*	kg Sb eq	9.65E-05	0	5.13E-07	1.03E-08	1.71E-07	-2.07E-05
ADP-fossil*	MJ	425	0	2.13	0.110	1.01	-161
WDP	m ³	7.15	0	0.007	0.001	0.031	-2.85

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

Acronyms

GWP-fossil = Global Warming Potential fossil fuels; **GWP-biogenic** = Global Warming Potential biogenic; **GWP-luluc** = Global Warming Potential land use and land use change; **ODP** = Depletion potential of the stratospheric ozone layer; **AP** = Acidification potential, Accumulated Exceedance; **EP-freshwater** = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; **EP-aquatic freshwater** = Eutrophication potential, fraction of nutrients reaching aquatic 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; **ADP-minerals&metals** = Abiotic depletion potential for non-fossil resources; **ADP-fossil** = Abiotic depletion for fossil resources potential; **WDP** = Water (user) deprivation potential, deprivation-weighted water consumption

Environmental Performance

Potential Environmental Impact *Additional Mandatory and Voluntary Indicators*

Results according to PCR2019:14 for 1m ² of A2 Aluminium Composite Panels							
Indicator	Unit	A1-3 Total	C1	C2	C3	C4	D
GWP-GHG ¹	kg CO ₂ eq	36.8	0	0.143	0.006	0.129	-15.9
Results according to EN 15804+A2 for 1m ² of A2 Aluminium Composite Panels							
PM	[disease inc.]	2.70E-06	0	9.06E-09	5.00E-10	6.90E-09	-1.08E-06
IRP	[kBq U235 eq]	0.907	0	0.009	0.001	0.004	-0.425
ET-freshwater	[CTUe]	4213	0	1.83	0.059	119	-441
HT-cancer	[CTUh]	4.08E-07	0	5.85E-11	1.83E-12	4.02E-11	-2.80E-08
HT-non-cancer	[CTUh]	1.73E-06	0	1.64E-09	4.56E-11	8.24E-10	-4.78E-07
SQP	[pt]	106	0	1.48	0.015	1.88	-28.0

Acronyms

GWP-GHG = Global Warming Potential total excl. biogenic carbon following IPCC AR5 methodology; **PM**= Particulate Matter **IRP** = Ionizing radiation, human health; **ET-freshwater** = Eco-toxicity (freshwater); **HT-cancer** = Human toxicity, cancer effects; **HT-non-cancer** = Human toxicity, non-cancer effects; **SQP** = Potential soil quality index (SQP)

¹ The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Use of Resources

Results according to EN 15804+A2 for 1m ² of A2 Aluminium Composite Panels							
Indicator	Unit	A1-3 Total	C1	C2	C3	C4	D
PERE	MJ	102.96	0	0.025	0.014	0.022	-53.9
PERM	MJ	0	0	0	0	0	0
PERT	MJ	50.3	0	0.122	0.002	0.051	-4.45
PENRE	MJ	451	0	2.26	0.116	1.07	-170
PENRM	MJ	0	0	0	0	0	0
PENRT	MJ	431	0	2.24	0.075	1.05	-160
SM	kg	1	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0
FW	m ³	1.32	0	0.002	0.001	0.002	-0.663

Acronyms

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 material; **RSF** = Use of renewable secondary fuels; **NRSF** = Use of non-renewable secondary fuels; **FW** = Use of net fresh water

Waste Production

Results according to EN 15804+A2 for 1m² of A2 Aluminium Composite Panels							
Indicator	Unit	A1-3 Total	C1	C2	C3	C4	D
Hazardous waste disposed	kg	0.026	0	0	0	0	0
Non-hazardous waste disposed	kg	0.004	0	0	0	6.80	0
Radioactive waste disposed	kg	0	0	0	0	0	0

Output Flows

Results according to EN 15804+A2 for 1m² of A2 Aluminium Composite Panels							
Indicator	Unit	A1-3 Total	C1	C2	C3	C4	D
Components for re-use	kg	0	0	0	0	0	0
Material for recycling	kg	0.029	0	0	0	0	1.70
Materials for energy recovery	kg	0.002	0	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0	0	0

References

- **ISO 14040** 2006 Environmental management - Life cycle assessment - Principles and framework
- **ISO 14044** 2006 Environmental management - Life cycle assessment - Requirements and guidelines
- **ISO 14025** 2006 Environmental labels and declarations - Type III environmental declarations - Principles and procedures
- **ISO 14020** 2000 Environmental labels and declarations - General principles
- **EN 15804:2012+A2:2019** Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- **The International EPD® System** www.environdec.com
- **The International EPD® System** The General Programme Instructions v3.01
- **The International EPD® System** PCR 2029:14 Construction products v1.1 (EN 15804:A2)
- **Ecoinvent 3.7** www.ecoinvent.org
- **SimaPro LCA Software** www.simapro.com
- **Asas Alüminyum Sanayi ve Ticaret A.Ş.** www.asastr.com

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