Environmental Product Declaration

as per ISO 14025 and EN 15804

Owner of the declaration:	PREFA Aluminiumprodukte GmbH
Publisher:	Kiwa BCS Öko-Garantie GmbH - Ecobility Experts
Programme holder:	Kiwa BCS Öko-Garantie GmbH - Ecobility Experts
Declaration number:	EPD-PREFABOND-084-EN
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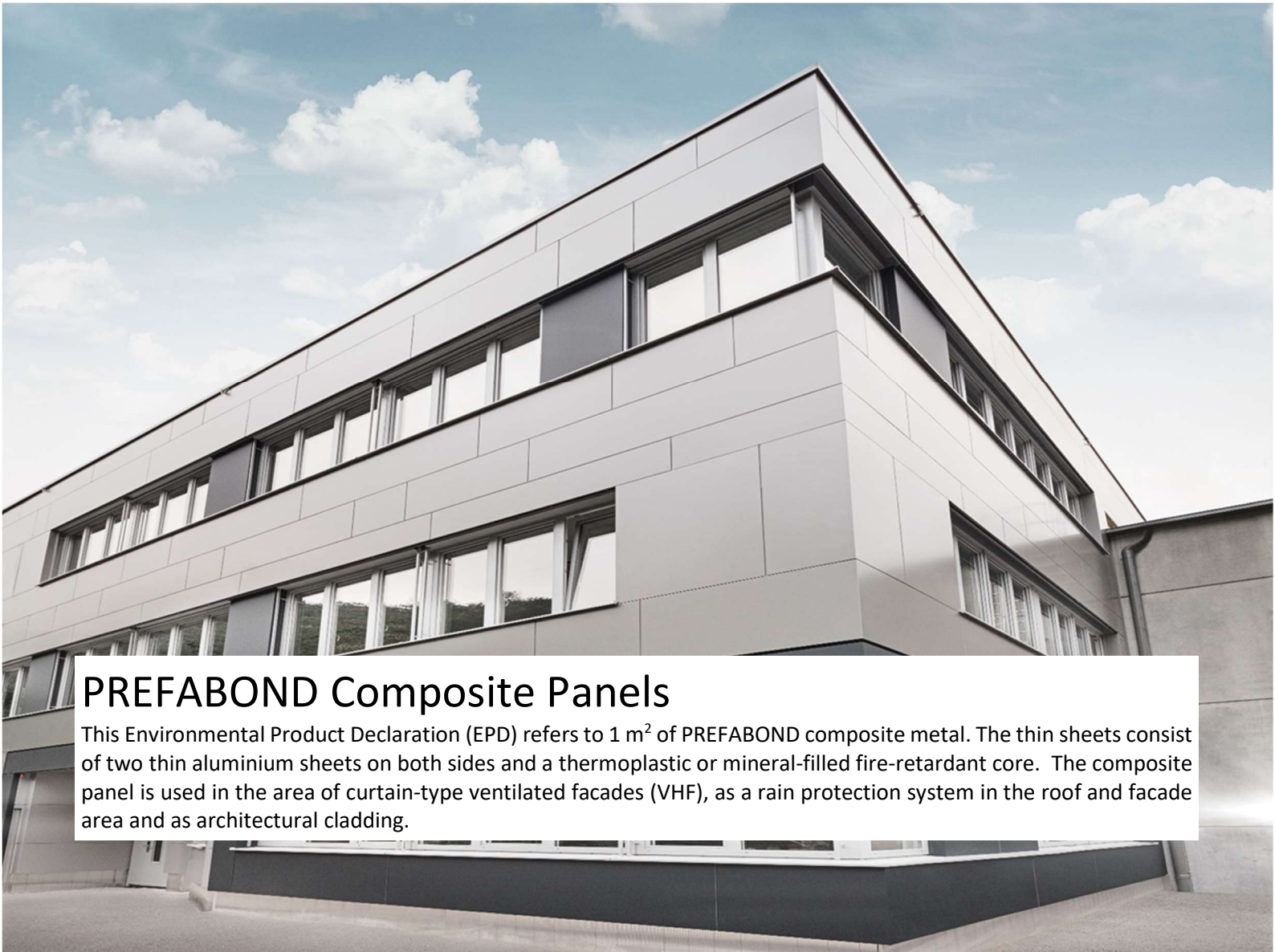

PREFABOND Composite Panels

This Environmental Product Declaration (EPD) refers to 1 m^2 of PREFABOND composite metal. The thin sheets consist of two thin aluminium sheets on both sides and a thermoplastic or mineral-filled fire-retardant core. The composite panel is used in the area of curtain-type ventilated facades (VHF), as a rain protection system in the roof and facade area and as architectural cladding.

1. General information

PREFA Aluminiumprodukte GmbH

Programme holder
Kiwa BCS Öko-Garantie GmbH
- Ecobility Experts
Marientorbogen 3-5
90402 Nürnberg
Deutschland/Germany

Declaration number
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This declaration is based on the Product Category Rules
Requirements for environmental product declarations for surface systems made of aluminium and aluminium alloys

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Signature
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Signature
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PREFABOND Composite Panels

Owner of the declaration
PREFA Aluminiumprodukte GmbH
Werkstraße 1
A-3182 Marktl/Lilienfeld

Declared product / declared unit
1 m^2 PREFABOND Composite Panel

Scope
PREFABOND composite panels are distributed by PREFA Aluminiumprodukte GmbH, based in Marktl/Lilienfeld. This EPD is based on a reference EPD. The products described here are identical to the products considered in the reference EPD.
Kiwa BCS Öko-Garantie GmbH –Ecobility Experts shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Verification
The CEN Norm EN 15804:2012-04 serves as the core PCR

Independent verification of the declaration and data according to ISO 14025:2011-10

☐internally ☒externally

Signature
Tim Lohse
(External verifier of Green Delta GmbH)

2. Product

2.1 Product description

PREFABOND composite panels are thin sheets consisting of two thin aluminium sheets on both sides and a thermoplastic or mineral filled fire retardant core. The already painted aluminium surfaces are provided with an adhesive foil and laminated with the core material.

PREFABOND products offer a huge range of surface types, colours and gloss levels for buildings. They are coated with robust and stable polyester lacquer varnish to keep surfaces fresh even after decades of weather exposure. PREFABOND composites offer the stiffness of heavy sheet metal in a lightweight composite.

2.2 Application

PREFABOND composites are ideal for architectural projects, are easy to process into complex shapes and are easy to install. At the same time, they offer excellent flatness, durability, stability, vibration damping and ease of maintenance. This makes them suitable for curtain walls, rain protection systems and other architectural cladding applications. PREFABOND can be machined with standard wood or metalworking tools without special tools. Cutting, grooving, punching, drilling, bending, rolling and many other manufacturing techniques can be easily performed to create a nearly unlimited variety of complex shapes and forms.

2.3 Technical Data

The technical data of PREFABOND composite panels with a nominal thickness of 4 mm can be found in the following table.

Characteristic	PREFABOND A2 ACM	PREFABOND fr ACM	PREFABOND fr real anodised ACM	Unit
Weight	8.4	7.6	7.6	kg/m^2
Thermal expansion /ASTM D696/	19	24	24	$x\ 10^{-6}/°C$
Thermal conductivity /ASTM D696/	0.63	0.45	0.45	W/(m.K)
Thermal resistance /ASTM D676/	0.15	0.16	0.16	$m^2.K/W$
Deflection temperature /ASTM D648/	110	116	116	°C
Tensile strength /ASTM E8/	43	49	49	$MPa, N/mm^2$
0,2% proof stress /ASTM E8/	41	44	44	$MPa, N/mm^2$
Elongation /ASTM E8/	3.8	5	5	%
Flexural elasticity /ASTM C393/	38.5	39.8	39	$GPa, kN/mm^2$
Flexural rigidity /ASTM C393/	204	137	137	$kN.mm^2/mm$
Punching shear resistance /D732/	37	32	32	$MPa, N/mm^2$
Sound transmission loss /ASTM E413/	27	27	27	dB
Metal thickness with equivalent rigidity	3.3	3.3	3.3	mm
Minimum bendable radius	600	100	Not applicable	mm

2.4 Placing on the market / Application rules

PREFABOND aluminium composite materials are used in accordance with the general building authority approval.

2.5 Base materials / Ancillary materials

PREFABOND- Composite materials consist of thin aluminium coils on both sides and a thermo-plastic or mineral-filled fire-retardant core. The already painted aluminium surfaces are provided with an adhesive foil and then laminated with the core material.

Description	Input	Unit
Aluminium coils	39	M.-%
Core material	60	M.-%
PE-based protective and adhesive film	1	M.-%

2.6 Manufacture

PREFABOND Aluminium composite metals (ACM) are produced by continuously joining two aluminium coils on both sides of an extruded thermoplastic or mineral-filled fire retardant thermoplastic core. The aluminium surfaces were pre-finished and coil-coated in various paints before bonding.

2.7 Reference Service Life

As the scope of the study does not cover the entire life cycle of the composite panel, the reference service life is a voluntary indication. According to /BBSR Table 2017/ No. 335.811, painted aluminium metal cladding achieves a reference life of more than 50 years.

2.8 Post-use phase

Deconstruction

The facade elements and flat panels can be removed non-destructively by unscrewing or drilling out the rivets, depending on the fastening system.

Reuse and further use

In undamaged form, the dismantled products can be used again according to their original purpose. If the elements are separated according to type, they can be shredded and the aluminium and the core can be recycled after treatment. In the case of pure aluminium recycling, the core material supports the melting process.

2.9 Disposal

There is no specific waste code according to the /European Waste Catalogue/ for aluminium composite panels from decommissioning. It is possible to allocate them according to EAK 17 09 04. Aluminium composite panels are generally accepted by metal scrap dealers on the basis of the daily updated aluminium scrap prices.

3. LCA: Calculation rules

3.1 Declared unit

According to the product category rules, 1 m^2 of composite material is chosen as the declared unit.

	Value	Unit
Declared Unit	1	m^2
Specific weight	8,4	kg/m^2
Conversion factor to 1 kg	0,12	-

3.2 System boundary

The Environmental Product Declaration is a cradle-to-gate EPD with consideration of additional life phases, i.e. all potential environmental impacts of the product from cradle to gate and the disposal phases of waste treatment and landfilling are considered. According to DIN EN 15804, this corresponds to product phases A1-A3 as well as C3 and C4. The table in chapter 5 provides an overview of the information modules or product life phases considered and of the product life phases not included in the life cycle assessment.

3.3 Estimates and assumptions

Some of the raw materials are transported by ship and truck. The transport distances were determined for all raw materials. It was assumed that about 20% of the transport distance was covered by truck and 80% by ship.

Part of the aluminium used has a secondary share of 50 - 60% or > 50%. For the life cycle assessment it was assumed that the secondary share is 50%, which corresponds to a worst-case scenario.

In the case of PE-based adhesive and protective films, some rubber and resin components are specified in the product data sheets. To simplify matters and due to the low overall relevance to the result, it was assumed that the films consist exclusively of PE.

For the disposal of the composite materials it is assumed that the aluminium content is recycled. Since the benefits and burdens of this further use would be reflected in Module D, the aluminium content is only considered in C3.

3.4 Cut-off criteria

All process-specific data were collected for the process modules A1 to A3. Potential environmental impacts could be assigned to almost all rivers through the GaBi database or alternative data sources. All flows contributing to more than 1% of the total mass, energy or environmental impact of the system were included in the Life Cycle Assessment. It can be assumed that the neglected processes would have contributed less than 5% to the impact categories considered.

3.5 Period under review

The production data have been recorded for the operating year 2018.

3.6 Comparability

In principle, a comparison or evaluation of EPD data is only possible if all data sets to be compared have been created in accordance with EN 15804 and the building context or the product-specific performance characteristics have been taken into account. The secondary data for the manufacturing phase were taken exclusively from the Gabi 6 software database.

4. LCA: Scenarios and additional technical information

End of life cycle (C1 to C4)

Name	Value	Unit
Separately collected waste	3.24	kg
Collected as mixed construction waste	5.16	kg
For reuse	0	kg
For Recycling	7.84	kg
For energy recovery	0.05	kg
For disposal	0.52	kg
For thermal utilisation	0	kg

5. LCA: Results

The following tables show the results of the impact assessment indicators, resource use, waste and other output streams. The results presented here refer to the declared average product.

Description of the system boundary (X = Included in LCA; MND = Module not declared)																
Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from manu-facturer to place of use	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishmen	Operational energy use	Operational water use	De-construction / demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
x	x	x	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	MND

Results of the LCA –Environmental impact: 1 m² PREFABOND Composite Panel				
Parameter	**Unit**	**A1 – A3**	**C3**	**C4**
Global warming potential	[kg CO_2-Eq.]	2.52E+01	2.31E-02	9.17E-03
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	8.35E-09	2.21E-13	9.19E-14
Acidification potential of land and water	[kg SO_2-Eq.]	9.73E-02	1.46E-04	4.97E-05
Eutrophication potential	[kg $(PO_4)^3$-Eq.]	1.63E-02	3.68E-05	7.66E-06
Formation potential of tropospheric ozone photchemical oxidants	[kg Ethen-Eq.]	3.32E-03	1.12E-05	3.27E-06
Abiotic depletion potential for non fossil resources	[kg Sb-Eq.]	1.26E-05	3.77E-08	3.03E-09
Abiotic depletion potential for fossil resources	[MJ]	3.42E+02	4.03E-01	1.09E-01

Results of the LCA –Resource use: 1 m² PREFABOND Composite Panel				
Parameter	**Unit**	**A1 – A3**	**C3**	**C4**
Renewable primary energy as energy carrier	[MJ]	7.87E+01	3.10E-02	1.28E-02
Renewable primary energy resources as material utilization	[MJ]	0.00E+00	0.00E+00	0.00E+00
Total use of renewable primary energy resources	[MJ]	7.87E+01	3.10E-02	1.28E-02
Non renewable primary energy as energy carrier	[MJ]	2.39E+02	4.13E-01	1.12E-01
Non renewable primary energy as material utilization	[MJ]	1.57E+02	0.00E+00	0.00E+00
Total use of non renewable primary energy resources	[MJ]	3.96E+02	4.13E-01	1.12E-01
Use of secondary material	[kg]	1.60E+00	-	-
Use of renewable secondary fuels	[MJ]	-	-	-
Use of non renewable secondary fuels	[MJ]	-	-	-
Use of net fresh water	[m³]	2.702E-01	6.27E-04	1.43E-04

Results of the LCA –Output flows and waste categories: 1 m² PREFABOND Composite Panel				
Parameter	**Unit**	**A1 – A3**	**C3**	**C4**
Hazardous waste disposed	[kg]	8.92E-04	2.95E-08	2.57E-09
Non hazardous waste disposed	[kg]	4.01E+01	2.15E-02	5.40E-01
Radioactive waste disposed	[kg]	2.12E-02	4.01E-06	1.57E-06
Building materials for re-use	[kg]	-	-	-
Materials for recycling	[kg]	7.84E+00	-	-
Materials for energy recovery	[kg]	5.16E-02	-	-
Exported energy	[MJ]	-	-	-

6. LCA: Interpretation

In the case of PREFABOND composite materials, the use of resources in all categories is dominated by the provision of raw materials, mainly aluminium coils. The provision of raw materials (A1) for the composite panels, for example, has a more than 90% effect on the total demand for non-renewable primary energy (PERNRT), while the transport and production phase (A3) only accounts for just under 5% each.
The use of renewable energy sources (PERT) is more influenced by electricity consumption, which is attributable to the share of renewable energy in the German electricity mix. Production accounts for almost 10% of renewable primary energy consumption.
Looking at the ratio of PERNRT to PERT, the share of renewable primary energy is between 3% (transport) and 30% (production phase), depending on the life cycle phase.

The impact categories are also dominated by the provision of raw materials, especially aluminium. In the case of GWP, the supply of aluminium accounts for approx. 90 % of all climate-relevant emissions, and approx. 5 % is attributable to transport and production. The raw materials also strongly influence the impact categories ADPE, ADPF and ODP with more than 90% each. In the case of the acidification potential AP, about 20 % is caused by transport, while in the case of the eutrophication potential EP it is 17 %. The packaging has a negligible influence on the results in all categories. The formation potential for tropospheric ozone (POCP) has a negative value in the area of transport, which is caused by direct emissions during transport. The ozone is degraded by the reaction with the emitted nitrogen monoxide and nitrogen dioxide and oxygen are produced, which has a positive effect on the formation potential of tropospheric ozone (POCP).
The results can be seen in the following diagram.

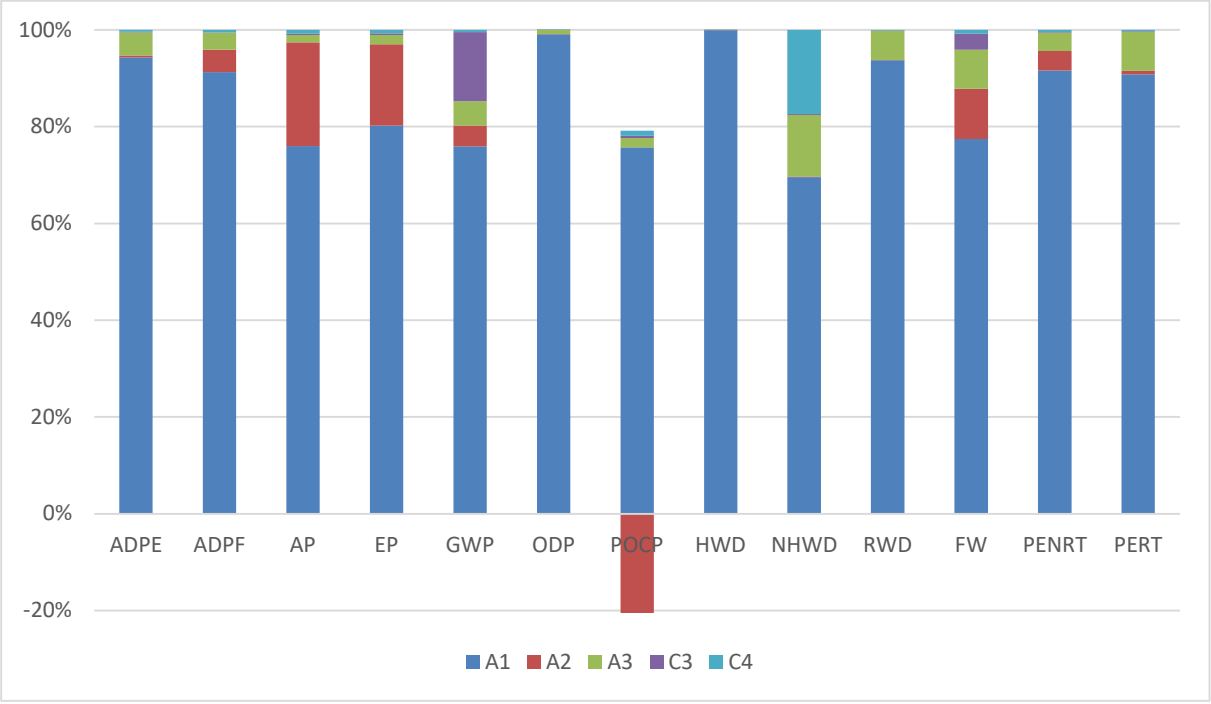

Figure 1: Proportionate representation of environmental impacts by impact category over the individual life cycle phases

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