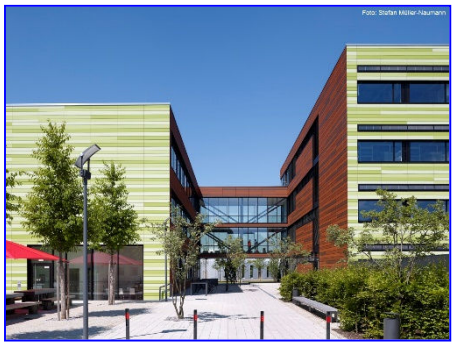
Environmental Product Declaration

Declaration Code: EPD-MFA-GB-48.0



Moeding Keramik-fassaden GmbH

Façades

Alphaton and Longoton ceramic façades

Basis:

DIN EN ISO 14025
EN15804

Company EPD **E**nvironmental **P**roduct **D**eclaration

Publication date:
17.10.2022

Next revision:
17.10.2027

www.ift-rosenheim.de/
published EPDs

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Prüfung und Kalibrierung – EN ISO/IEC 17025
Inspektion – EN ISO/IEC 17020
Zertifizierung Produkte – EN ISO/IEC 17065
Zertifizierung Managementsysteme – EN ISO/IEC 17021

Notified Body **0757**
PÜZ-Stelle: **BAY 18**

DAkkS Deutsche Akkreditierungsstelle D-ZE-11349-01-00

Environmental Product Declaration

Declaration Code: EPD-MFA-GB-48.0

Programme operator	ift Rosenheim GmbH Theodor-Gietl-Straße 7-9 D-83026 Rosenheim		
Practitioner of the LCA	ift Rosenheim GmbH Theodor-Gietl-Straße 7-9 D-83026 Rosenheim		
Declaration holder	Moeding Keramikfassaden GmbH Ludwig-Girnghuber-Straße 1 D-84163 Marklkofen www.moeding.de		
Declaration code	EPD-MFA-GB-48.0		
Designation of declared product	Alphaton and Longoton ceramic façades		
Scope	Façade cladding system from ceramics including aluminium substructure for commercial construction projects.		
Basis	This EPD was prepared on the basis of EN ISO 14025:2011 and DIN EN 15804:2012+A2:2019. In addition, the “Allgemeiner Leitfaden zur Erstellung von Typ III Umweltproduktdeklarationen” (Guidance on preparing Type III Environmental Product Declarations) applies. The Declaration is based on the PCR documents “PCR Part A” PCR-A-0.3:2018 and “Façades and roofs made of glass and plastic” PCR-FA-3.3:2018.		
Validity	Publication date: 17.10.2022	Last revision: 17.10.2022	Next revision: 17.10.2027
	This verified Company Environmental Product Declaration (company EPD) applies solely to the specified products and is valid for a period of five years from the date of publication in accordance with DIN EN 15804.		
LCA basis	The LCA was prepared in accordance with DIN EN ISO 14040 and DIN EN ISO 14044. The base data include both the data collected at the Moeding Keramikfassaden GmbH production site and the generic data derived from the “GaBi 10” database. LCA calculations were carried out for the “cradle to gate” life cycle with options (cradle to gate with options) including all upstream chains (e.g. raw material extraction, etc.).		
Notes	The “Conditions and Guidance on the Use of ift Test Documents” apply. The declaration holder assumes full liability for the underlying data, certificates and verifications.		

Christian Kehrer Head of Certification and Surveillance Body	Dr. Torsten Mielecke Chairman of Expert Committee ift-EPD and PCR	Susanne Volz External Verifier

1 General product information

Product definition

The EPD relates to the product group Façades and applies to:

1 m² of ceramic façade
made by Moeding Keramikfassaden GmbH

The functional unit is obtained by summing up:

Assessed product	Declared unit	Surface area of reference product	Weight per unit area
Longoton	1 m²	43.20 m²	46.76 kg/m²
Alphaton	1 m²	40.80 m²	52.95 kg/m²

Table 1: Product groups

The average unit is declared as follows:
Directly used material flows are determined using the total amounts produced and the average sizes of the ceramic tiles as well as the reference sizes of the façade elements (Longoton: 6.00 m x 7.20 m ; Alphaton: 6.00 m x 6.80 m) and assigned to the declared unit.

The reference period is the year 2020.

The validity of the EPD is restricted to the following series:
- Longoton
- Alphaton

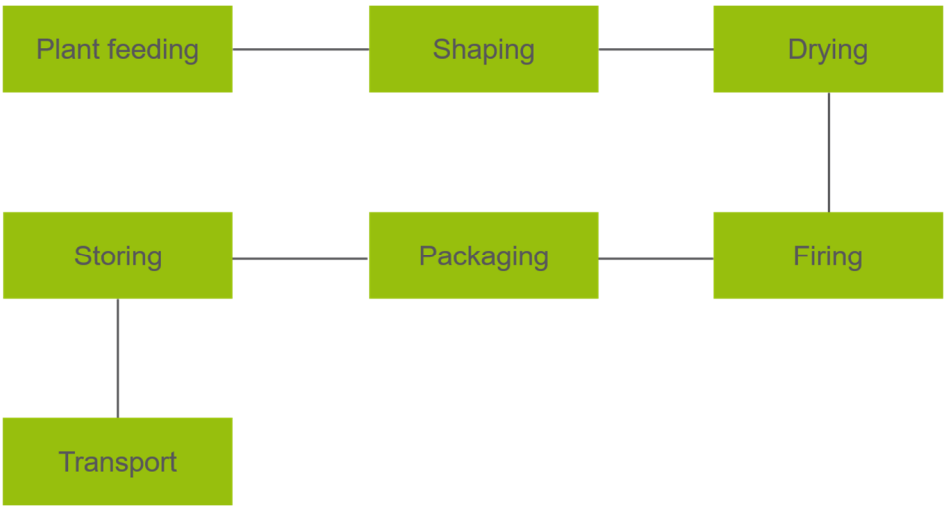
Product description

Longoton
The façade system is composed of ceramic tiles of 40 mm tile thickness, 1,000 mm maximum tile width and 3,000 mm maximum tile length. The tiles are mounted to an aluminium substructure made of support profiles, holders and joint profiles.

Alphaton ceramic façade
The façade system is composed of ceramic tiles of 30 mm tile thickness, 400 mm maximum tile width and 1,500 mm maximum tile length. The tiles are mounted to an aluminium substructure made of support profiles, holders and joint profiles.

For a detailed product description refer to the manufacturer specifications or the product specifications of the respective offer/quotation.

Product manufacture



Scope

Façade cladding system from ceramics including aluminium substructure for commercial construction projects. Façade system mainly for use in office and administration buildings, industrial buildings, public buildings and residential buildings.

Verifications

For updated verifications (incl. other national approvals) refer to www.moeding.de.

Additional information

For additional verification of applicability or conformity refer to the CE marking and the documents accompanying the product, if applicable.

2 Materials used

Primary materials

The primary materials used are listed in the LCA (see Section 7).

Declarable substances

The product contains no substances from the REACH candidate list (declaration dated 22 August 2022).

All relevant safety data sheets are available from Moeding Keramikfassaden GmbH.

3 Construction process stage

Processing recommendations, installation

Observe the instructions for mounting/installation, operation, maintenance and disassembly, provided by the manufacturer. For this see www.moeding.de

4 Use stage

Emissions to the environment

No emissions to indoor air, water and soil are known. There may be VOC emissions.

Reference service life (RSL)

The RSL information was provided by the manufacturer. The RSL shall be specified under defined reference in-use conditions and shall refer to the declared technical and functional performance of the product within the building. It shall be established in accordance with any specific rules given in European product standards, or, if not available, in a c-PCR. It shall also take into account ISO 15686-1, -2, -7 and -8. Where European product standards or a c-PCR provide guidance on deriving the RSL, such guidance shall have priority.
If it is not possible to determine the service life as the RSL in accordance with ISO 15686, the BBSR table "Nutzungsdauer von Bauteilen zur Lebenszyklusanalyse nach BNB" (service life of building components for life cycle assessment in accordance with the sustainable construction evaluation system) can be used. For further information and explanations refer to www.nachhaltigesbauen.de.

For this EPD the following applies:
For a "cradle to gate with options" EPD with the modules C1-C4 and module D (A1-A3 + C + D and one or more additional modules from A4 to B7), the reference service life (RSL) can only be stated if the reference in-use conditions have been specified.
According to the BBSR table, an optional service life of 50 years has been specified for ceramic façades made by Moeding Keramikfassaden GmbH.

The service life is dependent on the characteristics of the product and in-use conditions. The in-use conditions described in the EPD are applicable, in particular those listed below:

- Outdoor environment: climatic influences may have a negative impact on the service life.
- Indoor environment: no impacts (e.g., humidity, temperature) known that may have a negative effect on the reference service life

The service life solely applies to the characteristics specified in this EPD or the corresponding references.
The reference service life (RSL) does not reflect the actual life span, which is usually determined by the service life and the refurbishment of a building. It does not give any information on the useful life, warranty referring to performance characteristics or guarantees.

5 End-of-life stage

Possible end-of-life stages

The Alphaton and Longoton ceramic façades are shipped to central collection points. There the products are usually shredded and sorted into their original constituents. The end-of-life stage depends on the site where the products are used and is therefore subject to the local regulations. Observe the locally applicable regulatory requirements.

This EPD shows the end-of-life modules according to the market situation.

Specific steel and aluminium parts are recycled. Clay and residual fractions are sent to landfill.

Disposal routes

The LCA includes the average disposal routes.

All life cycle scenarios are detailed in the Annex.

6 Life Cycle Assessment (LCA)

Environmental product declarations are based on life cycle assessments (LCAs) which use material and energy flows for the calculation and subsequent representation of environmental impacts.

As the basis for this, Life Cycle Assessments (LCAs) were prepared for the Alphaton and Longoton ceramic façades. The LCAs are in conformity with the requirements set out in DIN EN 15804 and the international standards DIN EN ISO 14040, DIN EN ISO 14044, ISO 21930 and EN ISO 14025.

The LCA is representative of the products presented in the Declaration and the specified reference period.

6.1 Definition of goal and scope

Goal

The goal of the LCA is to demonstrate the environmental impacts of the products. In accordance with DIN EN 15804, the environmental impacts covered by this Environmental Product Declaration are presented for the entire product life cycle in the form of basic information. No other additional environmental impacts are specified.

Data quality, data availability and geographical and time-related system boundaries

The specific data originate exclusively from the fiscal year 2020. They were collected on-site at the plant located in Marklkofen and originate in parts from company records and partly from values directly obtained by measurement. Validity of the data was checked by the ift Rosenheim.

The generic data originate from the “GaBi 10” professional and building materials databases. The last update of both databases was in 2022. Data from before this date originate also from these databases and are not more than ten years old. No other generic data were used for the calculation.

Data gaps were either filled with comparable data or conservative assumptions, or the data were cut off in compliance with the 1% rule.

The life cycle was modelled using the “GaBi” sustainability software tool for the development of Life Cycle Assessments.

Scope / system boundaries

The system boundaries refer to the supply of raw materials and purchased parts, manufacture/production, use and end-of-life stage of Alphaton and Longoton ceramic façades.

No additional data from pre-suppliers/subcontractors or other sites were taken into consideration.

Cut-off criteria

All company data collected, i.e. all commodities/input and raw materials used, the thermal energy and electricity consumption, were taken into consideration.

The boundaries cover only the product-relevant data. Building sections/parts of facilities that are not relevant to the manufacture of the products, were excluded.

The transport distances of the pre-products used were taken into consideration as a function of >98% of the mass of products.
The remaining transport distances of the pre-products to the Marklkofen plant were taken into consideration based on a transport mix.
The transport mix is composed as follows and originates from the research project "EPDs für transparente Bauelemente" (EPDs for transparent building components).

- Truck, 26 – 28 t total weight / 18.4 t payload, Euro 6, freight, 85% capacity used, 100 km;
- Truck-trailer, 28– 34 t total weight / 22 t payload, Euro 6, 50% capacity used, 50 km;
- Freight train, electrical and diesel driven; D 60%, E 51% capacity used, 50 km
- Seagoing vessel, consumption mix, 50 km.

The criteria for the exclusion of inputs and outputs as set out in DIN EN 15804 are fulfilled. From the data analysis it can be assumed that the total of negligible processes per life cycle stage does not exceed 1% of the mass/primary energy. This way the total of negligible processes does not exceed 5% of the energy and mass input. The life cycle calculation also includes material and energy flows that account for less than 1%.

6.2 Inventory analysis

Goal

All material and energy flows are described below. The processes covered are presented as input and output parameters and refer to the declared/functional units.

Life cycle stages

The Annex shows the entire life cycle of the Alphaton and Longoton ceramic façades. Product stage "A1 – A3", construction process stage "A4 – A5", use stage "B2 – B7", end-of-life stage "C1 – C4" and the benefits and loads beyond the system boundaries "D" were taken into consideration.

Benefits

The below benefits have been defined as per DIN EN 15804:

- Benefits from recycling
- Benefits (thermal and electrical) from incineration

Allocation of co-products

The manufacture of the products does not give rise to any allocations.

Allocations for re-use, recycling and recovery

If the products are reused/recycled and recovered during the product stage (rejects), the components are shredded, if necessary and then sorted into their single constituents. This is done by various process plants, e.g. magnetic separators.
The system boundaries were set following their disposal, reaching the end-of-waste status.

Allocations beyond life cycle boundaries

Use of recycled materials in the manufacturing process was based on the current market-specific situation. In parallel to this, a recycling potential was taken into consideration that reflects the economic value of the product after recycling (recyclate) .
The system boundary set for the recycled material refers to collection.

Secondary material

The use of secondary material in module A3 by Moeding Keramikfassaden GmbH was not considered. Secondary material is not used.

Inputs

The LCA includes the following production-relevant inputs per 1 m^2 of ceramic façade:

Energy
The diesel input material is based on “Diesel Mix ab Tankstelle, Deutschland” (Germany diesel mix from filling station), the gas input material is based on “Erdgas Mix Deutschland” (Germany natural gas mix). The electricity mix is based on “Strommix Deutschland” (Germany electricity mix).

A portion of the process heat is used for space heating. This can, however, not be quantified, hence a “worst case” figure was taken into account for the product.

Water
The water consumed by the individual process steps for the manufacture amounts to a total of 100 l per 1 m^2 of Longoton ceramic façade and 120 l per 1 m^2 of Alphaton ceramic façade.
The consumption of fresh water specified in Section 6.3 originates (among others) from the process chain of the pre-products and the process water for cooling.

Raw material / pre-products
The chart below shows the share of raw materials/pre-products in percent.

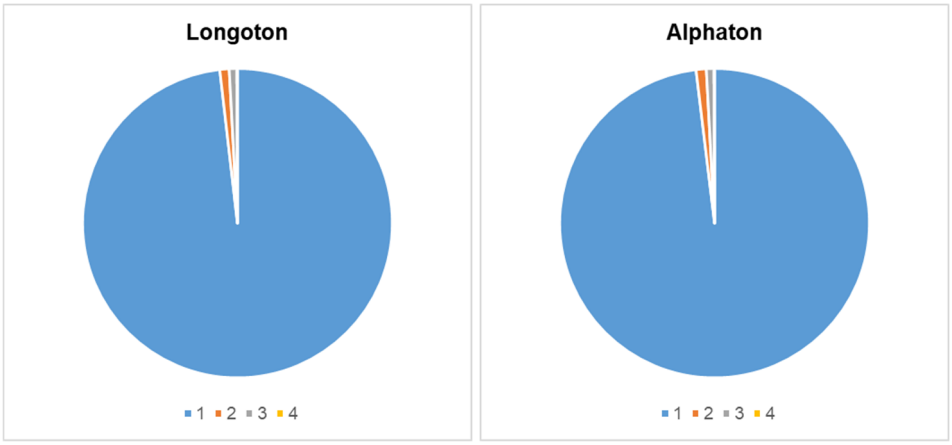


Figure 1: Percentage of individual materials per declared unit

No.	Material	Mass in %	
		Alphaton	Longoton
1	Clay	97	98
2	Aluminium	2	2
3	Glazes	<1	<1
4	Steel	<1	<1

Table 2: Percentage of individual materials per declared unit

Ancillary materials and consumables
Around 5 g of ancillary materials and consumables are used.

Product packaging
The amounts used for product packaging are as follows:

No.	Material	Mass in kg	
		Alphaton	Longoton
1	Polyethylene	0.24	0.21
2	Wood	1.14	1.01
3	Cardboard	0.07	0.07

Table 3: Weight in kg of packaging per declared unit

Biogenic carbon content
Only the biogenic carbon content of the associated packaging is specified, as the total mass of substances containing biogenic carbon is less than 5% of the total mass of the product and associated packaging. According to EN 16449, packaging produces the following amounts of biogenic carbon :

No.	Component	Content in kg C per m²	
		Alphaton	Longoton
1	Wood	0.51	0.45
2	Cardboard	0.03	0.03

Table 4: Biogenic carbon content of packaging at gate

Outputs

The LCA includes the production-relevant outputs per 1 m² of ceramic façade given below:

Waste
Secondary raw materials were included in the benefits.
See Section 6.3 - Impact assessment

Waste water
Manufacture produces 90 l waste water for the Longoton ceramic façade and 110 l for the Alphaton ceramic façade.

6.3 Impact assessment

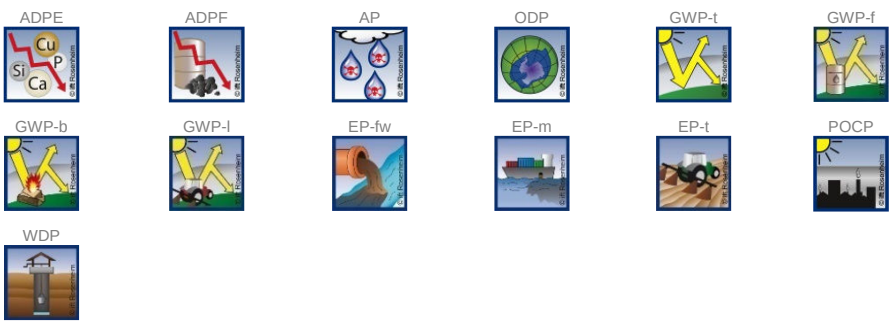
Goal

The impact assessment covers both inputs and outputs. The impact categories applied are named below:

Impact categories

The models for impact assessment were applied as described in DIN EN 15804-A2.
The impact categories presented in the EPD are as follows:

- depletion of abiotic resources – minerals and metals;
- depletion of abiotic resources– fossil fuels;
- acidification;
- ozone depletion;
- climate change - total
- climate change - fossil;
- climate change - biogenic;
- climate change – land use and land use change
- eutrophication aquatic fresh water;
- eutrophication aquatic marine;
- eutrophication terrestrial;
- photochemical ozone creation;
- water use.

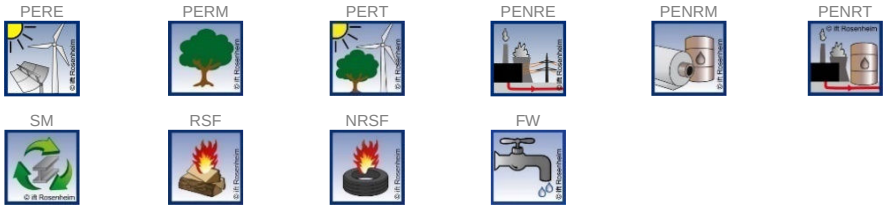


Use of resources

The models for impact assessment were applied as described in DIN EN 15804-A2.
The EPD presents the following indicators for the use of resources:

- renewable primary energy as energy resource;
- renewable primary energy for material use;

- total use of renewable primary energy;
- non-renewable primary energy as energy resource;
- renewable primary energy for material use;
- total use of non-renewable primary energy;
- use of secondary materials;
- use of renewable secondary fuels;
- use of non-renewable secondary fuels;
- net use of fresh water resources.

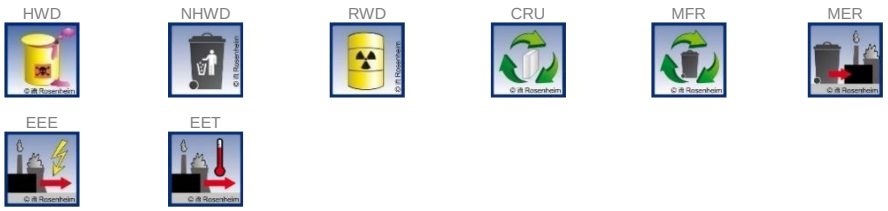


Waste

The waste generated during the production of 1 m² of ceramic façade is evaluated and shown separately for the fractions trade wastes, special wastes and radioactive wastes. Since waste handling is modelled within the system boundaries, the amounts shown refer to the deposited wastes. A portion of the waste indicated is generated during the manufacture of the pre-products.

The models for impact assessment were applied as described in DIN EN 15804-A2.
The waste categories and indicators for output material flows presented in the EPD are as follows:

- hazardous waste disposed;
- non-hazardous waste disposed;
- radioactive waste
- components for further use;
- materials for recycling;
- materials for energy recovery;
- exported electrical energy;
- exported thermal energy.



Additional environmental impact indicators

The models for impact assessment were applied as described in DIN EN 15804-A2.
The additional impact categories presented in the EPD are as follows:

- particulate matter emissions
- ionising radiation, human health
- eco-toxicity (fresh water)

- subcategory human toxicity - carcinogenic effect
- human toxicity - non-carcinogenic effect
- land use related impacts / soil quality

PM 

IRP 

ETP-fw 

HTP-c 

HTP-nc 

SQP 

Results per 1 m² of Longoton ceramic façade																
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Core indicators																
GWP-t	kg CO_2 eq.	37.76	0.35	2.45	ND	1.18E-02	0	0	0	0	0	0.00	0.27	3.16	0.67	-4.63
GWP-f	kg CO_2 eq.	39.25	0.34	0.57	ND	1.05E-02	0	0	0	0	0	0.00	0.27	3.12	0.69	-4.62
GWP-b	kg CO_2 eq.	-1.58	1.41E-04	1.88	ND	1.35E-03	0	0	0	0	0	0.00	1.09E-04	4.00E-02	-2.03E-02	-7.37E-03
GWP-l	kg CO_2 eq.	1.90E-02	1.28E-03	1.53E-05	ND	3.17E-06	0	0	0	0	0	0.00	9.87E-04	1.04E-03	1.27E-03	-9.92E-04
ODP	kg CFC -11 eq.	8.78E-09	4.90E-14	4.36E-13	ND	6.24E-14	0	0	0	0	0	0.00	3.78E-14	6.79E-11	1.63E-12	-1.41E-11
AP	mol H^+ eq.	0.08	3.63E-04	4.49E-04	ND	1.78E-05	0	0	0	0	0	0.00	3.03E-04	4.43E-03	4.87E-03	-1.87E-02
EP-fw	kg P eq.	7.02E-05	7.09E-07	1.03E-07	ND	1.44E-06	0	0	0	0	0	0.00	5.47E-07	1.37E-05	1.17E-06	-3.96E-06
EP-m	kg N eq.	2.04E-02	1.29E-04	1.22E-04	ND	1.10E-05	0	0	0	0	0	0.00	1.12E-04	1.42E-03	1.25E-03	-2.68E-03
EP-t	mol N eq.	0.22	1.52E-03	2.14E-03	ND	5.78E-05	0	0	0	0	0	0.00	1.30E-03	1.48E-02	1.37E-02	-2.91E-02
POCP	kg NMVOC eq.	5.77E-02	3.16E-04	3.23E-04	ND	1.51E-05	0	0	0	0	0	0.00	2.66E-04	3.49E-03	3.79E-03	-8.08E-03
ADPF*²	MJ	608.92	4.56	0.68	ND	0.14	0	0	0	0	0	0.00	3.52	39.50	9.00	-61.20
ADPE*²	kg Sb eq.	6.97E-06	3.55E-08	1.05E-08	ND	1.62E-09	0	0	0	0	0	0.00	2.73E-08	1.43E-06	7.08E-08	-5.17E-07
WDP*²	m^3 world eq. deprived	1.85	1.35E-03	0.25	ND	0.17	0	0	0	0	0	0.00	1.04E-03	7.15E-02	7.49E-02	-0.57
Use of resources																
PERE	MJ	114.28	0.27	17.58	ND	2.98E-02	0	0	0	0	0	0.00	0.21	31.50	1.36	-26.20
PERM	MJ	17.37	0.00	-17.37	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
PERT	MJ	131.65	0.27	0.21	ND	2.98E-02	0	0	0	0	0	0.00	0.21	31.50	1.36	-26.20
PENRE	MJ	604.60	4.57	4.97	ND	0.14	0	0	0	0	0	0.00	3.52	39.50	9.01	-61.20
PENRM	MJ	4.29	0.00	-4.29	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
PENRT	MJ	608.89	4.57	0.68	ND	0.14	0	0	0	0	0	0.00	3.52	39.50	9.01	-61.20
SM	kg	0.00	0.00	0.00	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
RSF	MJ	4.31E-31	0.00	0.00	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
NRSF	MJ	6.54E-30	0.00	0.00	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
FW	m^3	0.14	2.36E-04	5.87E-03	ND	0.13	0	0	0	0	0	0.00	1.82E-04	1.26E-02	2.28E-03	-5.41E-02
Waste categories																
HWD	kg	1.89E-04	2.11E-11	6.83E-11	ND	1.37E-11	0	0	0	0	0	0.00	1.63E-11	4.12E-09	4.63E-10	-6.08E-09
NHWD	kg	2.11	7.23E-04	6.77E-02	ND	3.56E-02	0	0	0	0	0	0.00	5.58E-04	3.91E-02	46.10	-1.06
RWD	kg	1.51E-02	4.59E-06	2.25E-05	ND	3.25E-06	0	0	0	0	0	0.00	3.54E-06	3.48E-03	9.87E-05	-3.54E-03
Output material flows																
CRU	kg	0.00	0.00	0.00	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
MFR	kg	0.16	0.00	0.00	ND	0.00	0	0	0	0	0	0.00	0.00	0.72	0.00	0.00
MER	kg	0.00	0.00	0.00	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
EEE	MJ	0.25	0.00	3.13	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
EET	MJ	0.58	0.00	7.31	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00

Key:
GWP-t – global warming potential - total **GWP-f** – global warming potential fossil fuels **GWP-b** – global warming potential - biogenic **GWP-l** – global warming potential - land use and land use change **ODP** – ozone depletion potential **AP** - acidification potential **EP-fw** - eutrophication potential - aquatic freshwater **EP-m** - eutrophication potential - aquatic marine **EP-t** - eutrophication potential - terrestrial **POCP** - photochemical ozone formation potential **ADPF*²** - abiotic depletion potential – fossil resources **ADPE*²** - abiotic depletion potential – minerals&metals **WDP*²** – Water (user) deprivation potential **PERE** - Use of renewable primary energy **PERM** - use of renewable primary energy resources **PERT** - total use of renewable primary energy resources **PENRE** - use of non-renewable primary energy **PENRM** - use of non-renewable primary energy resources **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** - net use of 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 **EEE** - exported electrical energy **EET** - exported thermal energy

Results per 1 m² of Longoton ceramic façade																
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Additional environmental impact indicators																
PM	Disease incidence	8.95E-07	2.25E-09	2.95E-09	ND	3.56E-10	0	0	0	0	0	0.00	1.8E-09	3.51E-08	5.99E-08	-1.90E-07
IRP*[1]	kBq U235 eq.	2.15	4.47E-04	2.23E-03	ND	3.22E-04	0	0	0	0	0	0.00	3.44E-04	0.35	1.07E-02	-0.67
ETP-fw*[2]	CTUe	95.16	3.62	0.27	ND	0.24	0	0	0	0	0	0.00	2.79	15.50	5.04	-18.90
HTP-c*[2]	CTUh	9.18E-09	7.18E-11	2.06E-11	ND	9.35E-12	0	0	0	0	0	0.00	5.54E-11	5.86E-10	7.7E-10	-2.21E-09
HTP-nc*[2]	CTUh	4.33E-07	3.61E-09	1.23E-09	ND	8.7E-10	0	0	0	0	0	0.00	2.79E-09	2.31E-08	8.52E-08	-4.96E-08
SQP*[2]	dimensionless	8.95E-07	2.25E-09	2.95E-09	ND	3.56E-10	0	0	0	0	0	0.00	1.8E-09	3.51E-08	5.99E-08	-1.90E-07

Key:
PM – particulate matter emissions potential **IRP*[1]** – ionising radiation potential – human health **ETP-fw*[2]** - Eco-toxicity potential – freshwater **HTP-c*[2]** - Human toxicity potential – cancer effects **HTP-nc*[2]** - Human toxicity potential – non-cancer effects **SQP*[2]** – soil quality potential

Disclaimers

*1 This impact category deals mainly with the eventual impact of low-dose ionising 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 ionising radiation from the soil, from radon and from some building materials is also not measured by this indicator

*2 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

Results per 1 m² of Alphaton ceramic façade																
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Core indicators																
GWP-t	kg CO_2 eq.	43.46	0.39	2.78	ND	1.18E-02	0	0	0	0	0	0.00	0.30	3.58	0.76	-5.45
GWP-f	kg CO_2 eq.	45.15	0.39	0.65	ND	1.05E-02	0	0	0	0	0	0.00	0.30	3.54	0.78	-5.44
GWP-b	kg CO_2 eq.	-1.80	1.60E-04	2.13	ND	1.35E-03	0	0	0	0	0	0.00	1.23E-04	4.52E-02	-2.30E-02	-8.38E-03
GWP-l	kg CO_2 eq.	2.16E-02	1.45E-03	1.74E-05	ND	3.17E-06	0	0	0	0	0	0.00	1.12E-03	1.18E-03	1.44E-03	-1.17E-03
ODP	kg CFC -11 eq.	9.93E-09	5.54E-14	4.95E-13	ND	6.24E-14	0	0	0	0	0	0.00	4.28E-14	7.69E-11	1.85E-12	-1.62E-11
AP	mol H^+ eq.	9.66E-02	4.11E-04	5.09E-04	ND	1.78E-05	0	0	0	0	0	0.00	3.43E-04	5.01E-03	5.51E-03	-2.21E-02
EP-fw	kg P eq.	7.99E-05	8.03E-07	1.17E-07	ND	1.44E-06	0	0	0	0	0	0.00	6.19E-07	1.55E-05	1.32E-06	-4.60E-06
EP-m	kg N eq.	2.30E-02	1.47E-04	1.38E-04	ND	1.10E-05	0	0	0	0	0	0.00	1.26E-04	1.61E-03	1.41E-03	-3.17E-03
EP-t	mol N eq.	0.25	1.72E-03	2.42E-03	ND	5.78E-05	0	0	0	0	0	0.00	1.48E-03	1.68E-02	1.55E-02	-3.44E-02
POCP	kg NMVOC eq.	6.54E-02	3.57E-04	3.65E-04	ND	1.51E-05	0	0	0	0	0	0.00	3.01E-04	3.95E-03	4.28E-03	-9.56E-03
ADPF*²	MJ	6.99E+02	5.17	0.77	ND	0.14	0	0	0	0	0	0.00	3.98	44.80	10.20	-71.90
ADPE*²	kg Sb eq.	7.95E-06	4.01E-08	1.20E-08	ND	1.62E-09	0	0	0	0	0	0.00	3.10E-08	1.61E-06	8.01E-08	-6.01E-07
WDP*²	m^3 world eq. deprived	2.20	1.52E-03	0.28	ND	0.17	0	0	0	0	0	0.00	1.18E-03	8.09E-02	8.48E-02	-0.68
Use of resources																
PERE	MJ	134.08	0.31	19.87	ND	2.98E-02	0	0	0	0	0	0.00	0.24	35.60	1.53	-30.80
PERM	MJ	19.64	0.00	-19.64	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
PERT	MJ	153.72	0.31	0.23	ND	2.98E-02	0	0	0	0	0	0.00	0.24	35.60	1.53	-30.80
PENRE	MJ	695.29	5.17	5.62	ND	0.14	0	0	0	0	0	0.00	3.99	44.80	10.20	-72.00
PENRM	MJ	4.84	0.00	-4.85	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
PENRT	MJ	700.13	5.17	0.77	ND	0.14	0	0	0	0	0	0.00	3.99	44.80	10.20	-72.00
SM	kg	0.00	0.00	0.00	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
RSF	MJ	5.04E-31	0.00	0.00	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
NRSF	MJ	7.65E-30	0.00	0.00	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
FW	m^3	0.17	2.67E-04	6.65E-03	ND	0.13	0	0	0	0	0	0.00	2.06E-04	1.43E-02	2.58E-03	-6.41E-02
Waste categories																
HWD	kg	2.14E-04	2.39E-11	7.75E-11	ND	1.37E-11	0	0	0	0	0	0.00	1.84E-11	4.66E-09	5.24E-10	-7.08E-09
NHWD	kg	2.61	8.19E-04	7.72E-02	ND	3.56E-02	0	0	0	0	0	0.00	6.31E-04	4.42E-02	52.10	-1.25
RWD	kg	1.77E-02	5.20E-06	2.55E-05	ND	3.25E-06	0	0	0	0	0	0.00	4.01E-06	3.94E-03	1.12E-04	-4.17E-03
Output material flows																
CRU	kg	0.00	0.00	0.00	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
MFR	kg	0.18	0.00	0.00	ND	0.00	0	0	0	0	0	0.00	0.00	0.86	0.00	0.00
MER	kg	0.00	0.00	0.00	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
EEE	MJ	0.25	0.00	3.54	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
EET	MJ	0.58	0.00	8.28	ND	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00

Key:
GWP-t – global warming potential - total **GWP-f** – global warming potential fossil fuels **GWP-b** – global warming potential - biogenic **GWP-l** – global warming potential - land use and land use change **ODP** – ozone depletion potential **AP** - acidification potential **EP-fw** - eutrophication potential - aquatic freshwater **EP-m** - eutrophication potential - aquatic marine **EP-t** - eutrophication potential - terrestrial **POCP** - photochemical ozone formation potential **ADPF*²** - abiotic depletion potential – fossil resources **ADPE*²** - abiotic depletion potential – minerals&metals **WDP*²** – Water (user) deprivation potential **PERE** - Use of renewable primary energy **PERM** - use of renewable primary energy resources **PERT** - total use of renewable primary energy resources **PENRE** - use of non-renewable primary energy **PENRM** - use of non-renewable primary energy resources **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** - net use of 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 **EEE** - exported electrical energy **EET** - exported thermal energy

Results per 1 m² of Alphaton ceramic façade															
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Additional environmental impact indicators																
PM	Disease incidence	1.04E-06	2.54E-09	3.35E-09	ND	3.56E-10	0	0	0	0	0	0.00	2.04E-09	3.97E-08	6.78E-08	-2.25E-07
IRP*[1]	kBq U235 eq.	2.58	5.06E-04	2.53E-03	ND	3.22E-04	0	0	0	0	0	0.00	3.90E-04	0.39	1.22E-02	-0.79
ETP-fw*[2]	CTUe	111.42	4.09	0.31	ND	0.24	0	0	0	0	0	0.00	3.16	17.50	5.70	-22.30
HTP-c*[2]	CTUh	1.08E-08	8.13E-11	2.34E-11	ND	9.35E-12	0	0	0	0	0	0.00	6.27E-11	6.63E-10	8.71E-10	-2.63E-09
HTP-nc*[2]	CTUh	5.00E-07	4.09E-09	1.40E-09	ND	8.70E-10	0	0	0	0	0	0.00	3.16E-09	2.62E-08	9.64E-08	-5.86E-08
SQP*[2]	dimensionless	355.06	1.62	0.24	ND	2.24E-02	0	0	0	0	0	0.00	1.25	24.20	2.21	-7.85

Key:
PM – particulate matter emissions potential **IRP*[1]** – ionising radiation potential – human health **ETP-fw*[2]** - Eco-toxicity potential – freshwater **HTP-c*[2]** - Human toxicity potential – cancer effects **HTP-nc*[2]** - Human toxicity potential – non-cancer effects **SQP*[2]** – soil quality potential

Disclaimers

*1 This impact category deals mainly with the eventual impact of low-dose ionising 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 ionising radiation from the soil, from radon and from some building materials is also not measured by this indicator

*2 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

6.4 Interpretation, LCA presentation and critical review

Evaluation

Calculation of the scenarios was based on a service life of 50 years. Furthermore, the scenarios of the research project "EPDs für transparente Bauelemente“ (EPDs for transparent building components) were used (1).
The standard scenarios selected are presented in bold type.

The environmental impacts of the

- Longoton ceramic façade
- Alphaton ceramic façade

differ sometimes. The differences are mainly due to the different amounts of energy used and the amounts of pre-products and raw materials used. This was to be expected in particular for the clay used. All in all, the Longoton ceramic façade has a lower environmental impact.

The environmental impacts during the manufacture of the ceramic façades result mainly from the use of the electric and thermal energies from natural gas. In addition, the role played by the aluminium profiles used as well as own and third party clay, should not be neglected.
The environmental impacts of electricity consumption in the end-of-life scenario C3 should also be considered.

For scenario C4 only marginal consumptions arising from the physical pre-treatment and management of the disposal site are expected.

As regards the recycling of the products, only marginal fractions of the environmental impacts of aluminium and steel can be assigned as benefits to scenario D.

The charts below show the distribution of the main environmental impacts.

The values obtained from the LCA calculation are suitable for the certification of buildings.

Charts

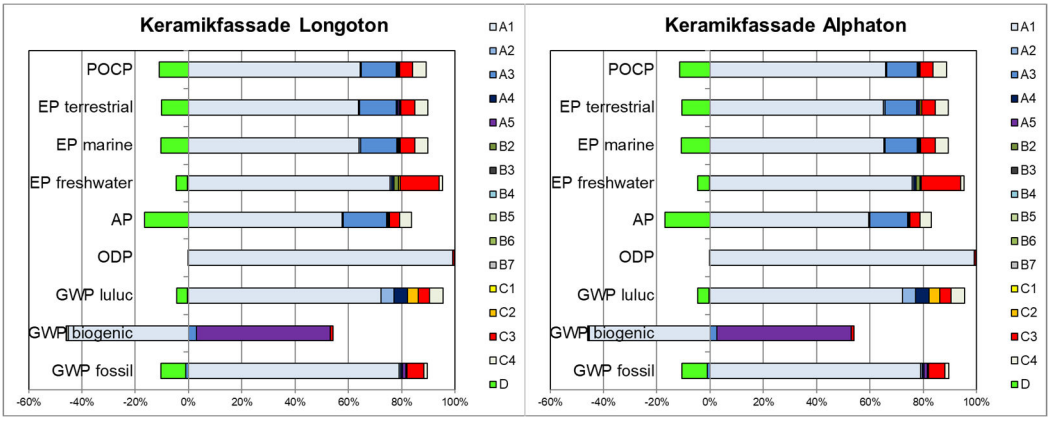


Figure 2: Percentage of the modules in selected environmental impact categories

Report

The LCA report underlying this EPD was developed according to the requirements of DIN EN ISO 14040 and DIN EN ISO 14044 as well as DIN EN 15804 and DIN EN ISO 14025. It is not addressed to third parties for reasons of confidentiality. It is deposited with the ift Rosenheim. The results and conclusions reported to the target group are complete, correct, without bias and transparent. The results of the study are not designed to be used for comparative statements intended for publication.

Critical review

The critical review of the LCA and the report took place in the course of verification of the EPD and was carried out by the external verifier Susanne Volz, MSc., (Graduate Business Lawyer).

7 General information regarding the EPD

Comparability

This EPD was prepared in accordance with DIN EN 15804 and is therefore only comparable to those EPDs that also comply with the requirements set out in DIN EN 15804.
Any comparison must refer to the building context and the same boundary conditions of the various life cycle stages.
For comparing EPDs of construction products, the rules set out in DIN EN 15804 (Clause 5.3) apply.

Communication

The communications format of this EPD meets the requirements of EN 15942:2012 and is therefore the basis for B2B communication. Only the nomenclature has been changed according to DIN EN 15804.

Verification

Verification of the Environmental Product Declaration is documented in accordance with the ift "Richtlinie zur Erstellung von Typ III Umweltproduktdeklarationen" (Guidance on preparing Type III Environmental Product Declarations) in accordance with the requirements set out in DIN EN ISO 14025.

The Declaration is based on the PCR - documents “PCR Part A” PCR-A-0.3-0.2:2018 and “Façades and roofs made of glass and plastic” PCR-FA-3.3:2018.

The European standard EN 15804 serves as the core PCR [a)]
Independent verification of the Declaration and statement according to EN ISO 14025:2010 ☐ internal ☒ external
Independent third party verifier: [b)] Susanne Volz
[a)] Product category rules [b)] Optional for business-to-business communication Mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)

Revisions of this document

No.	Date	Note:	Practitioner of the LCA	Verifier
1	16.10.2022	External Verification	Hilz	Volz
2				
3				

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9 Annex

Description of life cycle scenarios for Alphaton and Longoton ceramic façades.

Product stage			Con-struction stage		Use stage							End-of-life stage				Benefits and loads from beyond the system boundaries
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material supply	Transport	Manufacture	Transport	Construction/installation process	Use	Maintenance	Repair	Replacement	Modification/refurbishment	Operational energy use	Operational water use	Deconstruction/demolition	Transport	Waste processing	Disposal	Re-use Recovery Recycling potential
✓	✓	✓	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Calculation of the scenarios was based on a service building life of 50 years (in accordance with RSL of Section 4 Use stage).

The scenarios were based on information provided by the manufacturer. The scenarios were furthermore based on the research project "EPDs for transparent building components" (1).

Note: The standard scenarios selected are presented in bold type. They were also used for calculating the indicators in the summary table.

- ✓ Included in the LCA
- — Not included in the LCA

A4 Transport to the construction site

No.	Scenario	Description
A4	Standard scenario	40 t truck (Euro 0-6 mix), diesel, 27 t payload, 85% capacity used, approx. 150 km and empty return trip

A4 Transport to the construction site	Transport weight [kg/m²]
Longoton	48.06
Alphaton	54.41

Since only one scenario is used, the results are shown in the relevant summary table.

A5 Construction/Installation

No.	Scenario	Description
A5	Manual	According to the manufacturer the products are installed without additional lifting and auxiliary devices

In case of deviating consumption during installation/assembly of the products which forms part of the site management, they are covered at the building level.

Ancillary materials, consumables, use of energy and water, use of other resources, material losses as well as direct emissions during installation are negligible.

It is assumed that the packaging material in the module construction / installation is sent to waste handling. Waste is only thermally recycled in line with the conservative approach. Films/foils / protective covers, wood and cardboard in waste incineration plants recycling. Benefits from A5 are specified in module D. Benefits from waste incineration: electricity replaces electricity mix (DE); thermal energy replaces thermal energy from natural gas (DE).
Transport to the recycling plants is not taken into account.

Since only one scenario is used, the results are shown in the summary table.

B1 Use

Refer to Section 4 Use stage - Emissions to the environment. Emissions cannot be quantified.

B2 Inspection, maintenance, cleaning

Since only one scenario is used, the results are shown in the relevant summary table.

B2.1 Cleaning

No.	Scenario	Description
B2.1	Normal contamination	Manually using water according to manufacturer, annually (2.5 l / cleaning; 125 l / 50 yr)

Ancillary materials, consumables, use of energy, material losses and waste as well as transport distances during cleaning are negligible.

Since only one scenario is used, the results are shown in the relevant summary table.

B2.2 Maintenance

According to the manufacturer, no regular maintenance intervals are necessary.

B3 Repair

According to the manufacturer, no repair is necessary during the 50-year building service life.

For updated information refer to the respective instructions for assembly/installation, operation and maintenance from Moeding Keramikfassaden GmbH.

B4 Exchange / Replacement

It is assumed that no replacement will be necessary during the 50-year service life according to the BBSR Table and the 50-year building service life.

For updated information refer to the relevant manufacturer instructions for assembly/installation, operation and servicing/maintenance.

B5 Improvement / Modernisation

According to the manufacturer, the elements are not included in the improvement / modernisation activities for buildings.

In principle, disassembly of the systems is possible. If necessary, e.g., the building insulation attached to the back can be adjusted. After completion, the ceramic façade systems can be easily re-mounted.

For updated information refer to the respective instructions for assembly/installation, operation and maintenance from Moeding Keramikfassaden GmbH.

B6 Operational energy use

There is no energy used during normal use.

B7 Operational water use

No water consumption when used as intended. Water consumption for cleaning is specified in module B2.1.

C1 Deconstruction

No.	Scenario	Description
C1	**Deconstruction**	**Based on EN 17213 :** **Deconstruction of glass-free materials 95%** **Further deconstruction rates are possible, give adequate reasons.**

No relevant inputs or outputs apply to the scenario selected. The energy consumed for deconstruction is negligible. Any arising consumption is marginal.

Since only one scenario is used, the results are shown in the relevant summary table.

In case of deviating consumption the removal of the products forms part of the site management and is covered at the building level.

C2 Transport

No.	Scenario	Description
C2	Transport	Transport to collection point using 40 t truck (Euro 0-6 mix), diesel, 27 t payload, 80% capacity used, 50 km

Since only one scenario is used, the results are shown in the relevant summary table.

C3 Waste management

No.	Scenario	Description
C3.4	Current market situation	Share for recirculation of materials: • 98% steel in melt (UBA, 2017) • 95% aluminium in melt (GDA, 2018) • remainder to landfill:

Electricity consumption of incineration plant: 0.5 MJ/kg.

The below table shows the disposal processes and their percentage by mass/weight. The calculation is based on the above mentioned shares in percent related to the declared unit of the product system.

C3 Disposal	Unit	Longoton	Alphaton
Collection process, collected separately	kg	44.42	50.30
Collection process, collected as mixed construction waste	kg	2.34	2.65
Recovery system, for re-use	kg	0.00	0.00
Recovery system, for recycling	kg	0.72	0.86
Recovery system, for energy recovery	kg	0.00	0.00
Disposal	kg	46.04	52.09

The 100% scenarios differ from current average recycling (C3.4). The evaluation of the individual scenarios is presented in the underlying report.

Since only one scenario is used, the results are shown in the relevant summary table.

C4 Disposal		
No.	**Scenario**	**Description**
C4	**Disposal**	**The non-recordable amounts and losses within the re-use/recycling chain (C1 and C3) are modelled as "disposed" (DE).**
The consumption in scenario C4 results from physical pre-treatment, waste recycling and management of the disposal site. The benefits obtained here from the substitution of primary material production are allocated to module D, e.g. electricity and heat from waste incineration. Since only one scenario is used, the results are shown in the relevant summary table.		
D Benefits and loads from beyond the system boundaries		
No.	**Scenario**	**Description**
D.1	**Recycling potential**	**Aluminium recyclate from C3 excluding the recyclate used in A3 replaces 60% of aluminium compound; Steel scrap from C3 excluding the scrap used in A3 replaces 60% of steel; Benefits from waste incineration: electricity replaces electricity mix (DE); thermal energy replaces thermal energy from natural gas (DE).**
The values in module D result from recycling of the packaging material in module A5 and from deconstruction at the end of service life. The 100% scenarios differ from current average recycling (D.1). The evaluation of the individual scenarios is presented in the underlying report. Since only one scenario is used, the results are shown in the relevant summary table.		

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Notes
This EPD is mainly based on the work and findings of the Institut für Fenstertechnik e.V., Rosenheim (ift Rosenheim) and specifically on the ift-Richtlinie NA-01/3 Allgemeiner Leitfaden zur Erstellung von Typ III Umweltproduktdeklarationen. (Guideline NA.01/3 - Guidance on preparing Type III Environmental Product Declarations)

Layout
ift Rosenheim GmbH – 2021

Photographs (front page)
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