ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025

PHILIPS - EM251B REC 4S OA/CO NM3 ELD

Signify N.V.



EPD HUB, HUB-8162

Published on 19.11.2026, last updated on 19.11.2026, valid until 18.11.2031

MANUFACTURER AND SITE

Manufacturer	Signify N.V.
Address	High Tech Campus 48, 5656 AE Eindhoven, The Netherlands
Contact details	sustainability@signify.com
Website	https://www.signify.com/global
Place of production	HUIZHOU, CHINA
Place(s) of raw material origin	APAC
Place(s) of installation and use	EU
Period for data	Calendar Year 2025

EPD STANDARDS, SCOPE AND VERIFICATION

Program operator	EPD Hub, hub@epdhub.com
Reference standard	EN 15804:2012+A2:2019/AC:2021 and ISO 14025
PCR	EPD Hub Core PCR version 1.2, 24 Mar 2025
Sector	Electrical product
Category of EPD	Third party verified EPD
Scope of the EPD	Cradle to gate with options, A4-A5, B6, and modules C1-C4, D
EPD author	Signify / Sustainability
EPD verification	Independent verification of this EPD and data, according to ISO 14025: ☐ Internal verification ☑ External verification
EPD verifier	Yazan Badour

PRODUCT SPECIFICATION

Product name	PHILIPS - EM251B REC 4S OA/CO NM3 ELD
Product number / reference	912401483614
GTIN (Global Trade Item Number)	Not applicable
NOBB (Norwegian Building Product Database)	Not applicable
A1-A3 Specific data (%)	14

PRODUCT DESCRIPTION

Recessed emergency downlight with DALI communication
400lm non-maintained operation for 3hrs
LiFePO4 battery pack
5-year warranty

This EPD is intended for business-to-business and/or business-to-consumer communication. Life Cycle Assessment study has been performed in accordance with the requirements of EN 15804, EPD Hub PCR version 1.2 (24 Mar 2025) and JRC characterization factors EF 3.1. The manufacturer has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

PRODUCT CLASSIFICATION

Declared operating voltage, Volt	230-240 V
Light source colour temperature, Kelvin	5000 K
Protection index for water and dust (IP)	IP20
Impact resistance index (IK)	IK03
Luminous flux, Lumens	400
Electrical power, Watt	4
Luminous efficiency, Lm/W	100
Additional characteristic	With replaceable optical lenses

ABOUT THE MANUFACTURER

Signify is the world leader in lighting for professionals, consumers and lighting for the Internet of Things. Our energy efficient lighting products, systems and services enable our customers to enjoy a superior quality of light, and make people's lives safer and more comfortable, businesses more productive and cities more liveable.

For more information, please visit: https://www.signify.com/global

PRODUCT RAW MATERIAL MAIN COMPOSITION

Raw material category	Amount, mass- %	Material origin
Metals	32.93	APAC
Minerals	22.22	APAC
Fossil materials	44.72	APAC
Bio-based materials	0.02	APAC

BIOGENIC CARBON CONTENT

Product's biogenic carbon content at the factory gate

Biogenic carbon content in product, kg C	0
Biogenic carbon content in packaging, kg C	0.029

ENVIRONMENTAL DATA SUMMARY

Declared unit	1 unit
Declared unit mass, kg	0.459
Mass of packaging, kg	0.07
Functional unit (from PEP PSR0014)	Provide lighting that delivers an outgoing artificial luminous flux of 1000 lumens during a reference lifetime of 35000 hours
Reference service life (years)	20
Assigned lifetime (hours)	50000
GWP-total, A1-A3 (kg CO_2e)	8.14
GWP-fossil, A1-A3 (kg CO_2e)	8.23
Secondary material, inputs (%)	11.5
Secondary material, outputs (%)	31
Total energy use, A1-A3 (kWh)	31
Net freshwater use, A1-A3 (m^3)	6.84E-02

LIFE CYCLE ASSESSMENT

SYSTEM BOUNDARY

This EPD covers the life-cycle modules listed in the following table.

Product stage			Installation stage		Use stage							End of life stage				Beyond the system
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	ND	ND	ND	ND	ND	X	ND	X	X	X	X	X
Raw materials	Transport	Manufacturing	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstr./demo.	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling

Modules not declared = ND.

CUT - OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in the reference standard and the applied PCR. The study does not exclude any hazardous materials or substances. There is no neglected unit process more than 1% of total mass or energy flows. The module-specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

The production of capital equipment, construction activities, and infrastructure, maintenance and operation of capital equipment, personnel-related activities, energy and water use related to company management and sales activities are excluded.

VALIDATION OF DATA

Data collection for production, transport, and packaging was conducted using time and site-specific information, as defined in the general information section on page 1 and 2. Upstream process calculations rely on generic data as defined in the Bibliography section. Manufacturer-provided specific and generic data were used for the product's manufacturing stage. The analysis was performed in One Click LCA EPD Generator, with the 'Cut-Off, EN 15804+A2' allocation method, and characterization factors according to EN 15804:2012+A2:2019/AC:2021 and JRC EF 3.1.

ALLOCATION, ESTIMATES AND ASSUMPTIONS

Allocation is required if some material, energy, and waste data cannot be measured separately for the product under investigation. All allocations are done as per the reference standards and the applied PCR. In this study, ancillary materials, energy & water consumption, material loss and waste generation at the manufacturing site are attributed to the bill of materials of the products, therefore, they are allocated by partitioning the quantities on the base of the total production in kg throughout the year. Thus, allocation has been done in the following ways:

Data type	Allocation
Raw materials	No allocation
Packaging materials	No allocation
Ancillary materials	Allocated by mass
Manufacturing energy and waste	Allocated by mass

Proxy data is used for certain materials due to their unavailability in the database. Conservative choices have been adopted when exact information was missing. Regarding module C1-C4: EOL scenarios are based on default values from EN 50693. For stages description please refer to section 'Product life cycle' in this EPD report.

LCA SOFTWARE AND BIBLIOGRAPHY

This EPD has been created using One Click LCA Luminaire EPD Generator v2.2.7. The LCA and EPD have been prepared according to the reference standards, EN 50693, and ISO 14040/14044. Ecoinvent v 3.10.1 and One Click LCA databases were used as sources of environmental data. Allocation used in Ecoinvent 3.10.1 environmental data sources follow the methodology ‘allocation, cut-off, EN 15804+A2‘.

No other sources were used in the modelling of this EPD.

PRODUCT & MANUFACTURING SITES GROUPING

Type of grouping	No grouping
Grouping method	Not applicable
Variation in GWP-fossil for A1-A3, %	-

SUBSTANCES, REACH - VERY HIGH CONCERN

The product does not contain any REACH SVHC substances in amounts greater than 0,1 % (1000 ppm).

PRODUCT LIFE CYCLE

MANUFACTURING AND PACKAGING (A1-A3)

The environmental impacts considered for the product stage cover the manufacturing of raw materials used in the production. The material losses occurring during the manufacturing processes are treated as per the waste handling practices in the factory, while scenario assumptions are made in the absence of exact data. The study also considers the fuels used by machines as well as losses during electricity transmission.

The product is made of metals, plastics, and electronic components. All components are transported to the production facility, where the main manufacturing processes primarily are associated with assembly. A2 transport distances are calculated always taking the capital city of component country of origin as a starting point and exact manufacturing location as destination. The finished product can be packaged with polyethylene, cardboard, and/or paper as packaging material before shipment to customers. Manufacturing loss, ancillaries and wastes are calculated according to the data that each manufacturing site is sharing with Signify. The total annual amount of waste in kg is allocated to the total annual production in kg at the specific manufacturing site responsible to produce the studied product. Thus, it is possible to allocate it according to the weight of the product analysed in this study.

Co-product allocation is neglected as revenue of co-product is very low, hence, the waste undergoes a conservative waste treatment.

TRANSPORT AND INSTALLATION (A4-A5)

A4 transport distances are calculated always taking the exact manufacturing location to customer location. If the customer's location is defined as a country or its capital city, the calculation is made to the respective capital city. If the customer's location is specified as a region, the distance is calculated to the capital city of the best-performing sales country within that region. The transportation method is a combination of lorry and container ship where needed. To be conservative, empty returns are included in this study as implemented through an average load factor in the Ecoinvent transport datapoints. Environmental impacts from installation include waste packaging materials (A5). The packaging waste treatment is assumed to be conservative with incineration without energy recovery. The impacts of energy consumption and the used ancillary materials during installation are considered negligible.

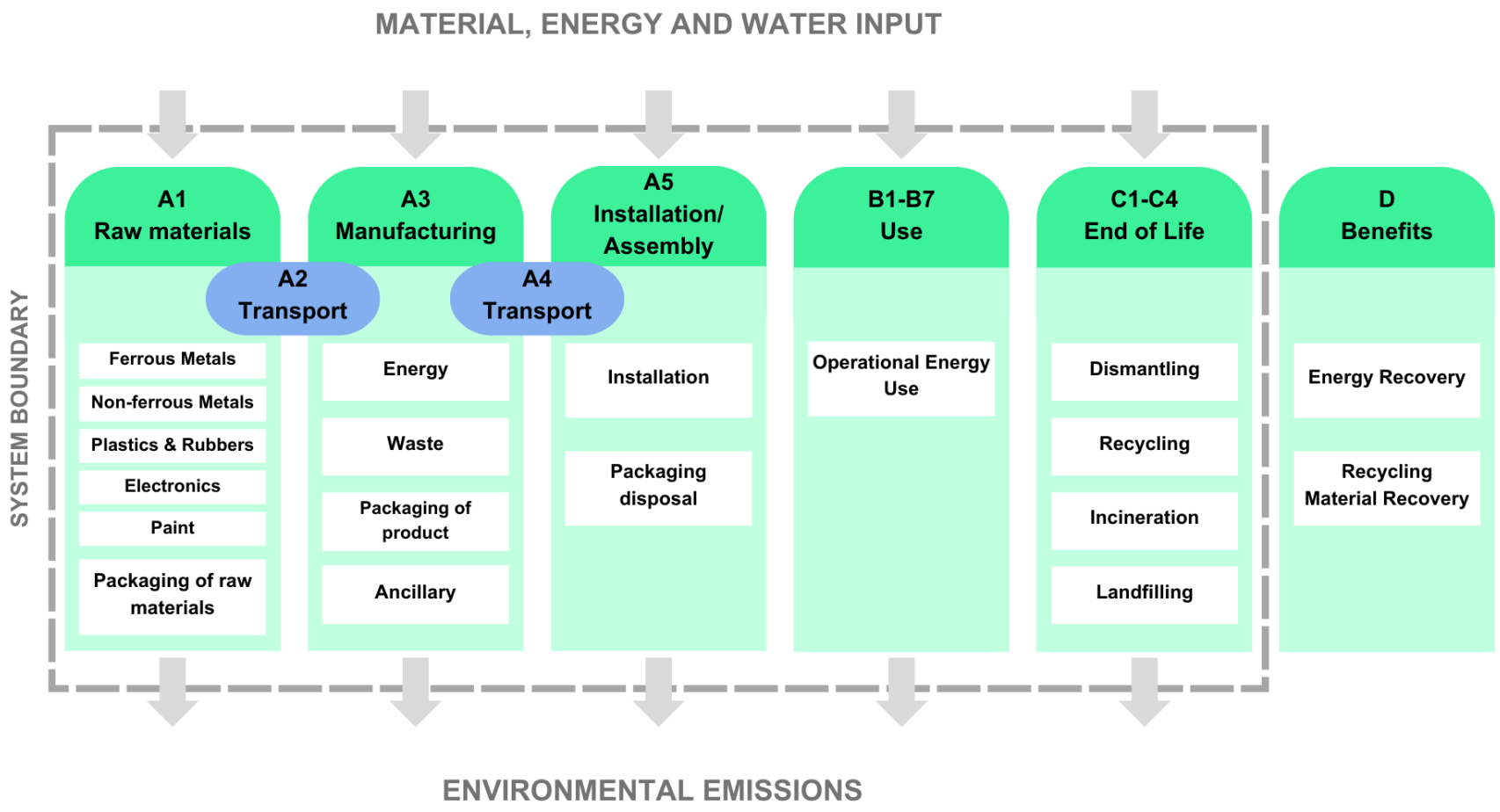
PRODUCT USE AND MAINTENANCE (B1-B7)

During the use phase, the product consumes electricity (B6), which is calculated multiplying the Wattage x Assigned lifetime (hours) x Country energy mix factor. To know which Country energy mix was used in this EPD, please refer to Annex 2. The Reference service life in years is calculated according to the main application type of the product, based on annual operating hours. Impacts due to electricity production include direct emissions to air, transformation, and transmission losses.

PRODUCT END OF LIFE (C1-C4, D)

Consumption of energy and natural resources in demolition process is assumed to be negligible. It is assumed that the waste is collected separately and transported to the waste treatment centre. The transport distance is 150 km while the transportation method is assumed to be lorry (C2). According to EN 50693:2019, the sequence of treatment operations occurring to the product shall include de-pollution, fractions separation and preparation (dismantling, crushing, shredding, sorting), recycling, other material recovery, energy recovery and disposal. In this study, the default values from table G.4 of EN 50693 is used for treating materials in different waste treatment methods. Due to the material and energy recovery potential of parts in the lighting system, the end-of-life product is converted into recycled raw materials, while the energy recovered from incineration displaces electricity and heat production (D). The benefits and loads of incineration and recycling are included in Module D.

LIFE CYCLE FLOW DIAGRAM - SYSTEM BOUNDARY



ENVIRONMENTAL IMPACT DATA, RESULTS PER DECLARED UNIT

The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP – total[1)]	kg CO_2e	7.40E+00	5.44E-02	6.87E-01	8.14E+00	1.46E-01	1.13E-01	ND	ND	ND	ND	ND	6.58E+01	ND	0.00E+00	1.35E-02	1.34E-01	6.49E-02	-1.54E+00
GWP – fossil	kg CO_2e	7.44E+00	5.43E-02	7.35E-01	8.23E+00	1.46E-01	4.39E-03	ND	ND	ND	ND	ND	6.55E+01	ND	0.00E+00	1.35E-02	1.34E-01	6.49E-02	-1.54E+00
GWP – biogenic	kg CO_2e	-4.71E-02	1.23E-05	-4.85E-02	-9.55E-02	2.51E-05	1.08E-01	ND	ND	ND	ND	ND	1.47E-01	ND	0.00E+00	2.94E-06	-1.92E-06	8.89E-06	-1.54E-03
GWP – LULUC	kg CO_2e	1.17E-02	2.43E-05	4.32E-04	1.21E-02	7.58E-05	1.62E-06	ND	ND	ND	ND	ND	2.01E-01	ND	0.00E+00	5.96E-06	3.38E-05	4.35E-06	-1.30E-03
Ozone depletion pot.	kg CFC_{-11}e	1.52E-07	8.02E-10	7.23E-09	1.60E-07	2.11E-09	6.04E-11	ND	ND	ND	ND	ND	1.21E-06	ND	0.00E+00	1.88E-10	1.84E-10	8.82E-11	-8.39E-09
Acidification potential	mol H^+e	7.30E-02	1.85E-04	3.53E-03	7.68E-02	3.42E-03	2.61E-05	ND	ND	ND	ND	ND	3.85E-01	ND	0.00E+00	4.49E-05	1.49E-04	3.32E-05	-6.60E-02
EP-freshwater[2)]	kg Pe	5.47E-03	4.23E-06	1.56E-04	5.63E-03	6.14E-06	4.41E-07	ND	ND	ND	ND	ND	6.09E-02	ND	0.00E+00	1.05E-06	9.20E-06	5.75E-07	-3.59E-03
EP-marine	kg Ne	9.23E-03	6.09E-05	5.48E-04	9.84E-03	8.60E-04	1.22E-05	ND	ND	ND	ND	ND	6.04E-02	ND	0.00E+00	1.45E-05	3.91E-05	1.23E-04	-3.42E-03
EP-terrestrial	mol Ne	9.94E-02	6.62E-04	5.12E-03	1.05E-01	9.55E-03	1.11E-04	ND	ND	ND	ND	ND	5.41E-01	ND	0.00E+00	1.58E-04	3.92E-04	1.47E-04	-4.39E-02
POCP ("smog")[3)]	kg NMVOCe	3.62E-02	2.73E-04	2.19E-03	3.87E-02	2.64E-03	3.16E-05	ND	ND	ND	ND	ND	1.78E-01	ND	0.00E+00	6.25E-05	1.08E-04	4.49E-05	-1.31E-02
ADP-minerals & metals[4)]	kg Sbe	9.45E-04	1.52E-07	6.25E-07	9.46E-04	2.03E-07	1.31E-08	ND	ND	ND	ND	ND	8.84E-04	ND	0.00E+00	4.42E-08	3.72E-07	1.17E-08	-8.96E-04
ADP-fossil resources	MJ	9.78E+01	7.88E-01	8.89E+00	1.07E+02	1.86E+00	4.54E-02	ND	ND	ND	ND	ND	1.52E+03	ND	0.00E+00	1.89E-01	2.56E-01	6.99E-02	-1.67E+01
Water use[5)]	m^3e depr.	2.31E+00	3.89E-03	4.27E+00	6.58E+00	6.24E-03	5.26E-03	ND	ND	ND	ND	ND	4.15E+01	ND	0.00E+00	8.76E-04	1.19E-02	4.24E-03	-4.46E-01

1) GWP = Global Warming Potential. 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO4e. 3) POCP = Photochemical ozone formation. 4) ADP = Abiotic depletion potential. 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Particulate matter	Incidence	5.45E-07	5.44E-09	1.05E-08	5.61E-07	6.68E-09	3.25E-10	ND	ND	ND	ND	ND	1.37E-06	ND	0.00E+00	1.07E-09	1.46E-09	5.40E-10	-1.53E-07
Ionizing radiation[6)]	kBq U235e	5.56E-01	6.87E-04	1.07E-02	5.68E-01	1.04E-03	5.50E-05	ND	ND	ND	ND	ND	4.21E+01	ND	0.00E+00	1.53E-04	2.10E-03	8.00E-05	-1.15E-01
Ecotoxicity (freshwater)	CTUe	1.20E+02	1.12E-01	1.59E+00	1.22E+02	1.70E-01	1.26E-01	ND	ND	ND	ND	ND	2.32E+02	ND	0.00E+00	2.99E-02	3.02E-01	2.24E+00	-5.15E+01
Human toxicity, cancer	CTUh	6.24E-09	8.97E-12	8.85E-11	6.34E-09	2.94E-11	6.06E-12	ND	ND	ND	ND	ND	2.21E-08	ND	0.00E+00	2.29E-12	1.80E-11	2.37E-11	-7.97E-09
Human tox. non-cancer	CTUh	2.86E-07	5.11E-10	4.05E-09	2.91E-07	6.50E-10	2.47E-10	ND	ND	ND	ND	ND	1.15E-06	ND	0.00E+00	1.18E-10	9.96E-10	1.06E-09	-8.03E-07
SQP[7)]	-	3.73E+01	7.94E-01	8.44E+00	4.65E+01	5.97E-01	2.22E-02	ND	ND	ND	ND	ND	3.39E+02	ND	0.00E+00	1.13E-01	1.51E-01	1.20E-01	-2.14E+01

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renew. PER as energy[8)]	MJ	1.02E+01	1.08E-02	-1.22E-01	1.01E+01	1.72E-02	-1.24E+00	ND	ND	ND	ND	ND	4.18E+02	ND	0.00E+00	2.59E-03	3.48E-02	-3.26E-04	-1.79E+00
Renew. PER as material	MJ	5.37E-01	0.00E+00	5.81E-01	1.12E+00	0.00E+00	-1.12E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	-1.58E-04	-1.63E-03	0.00E+00
Total use of renew. PER	MJ	1.07E+01	1.08E-02	4.59E-01	1.12E+01	1.72E-02	-2.36E+00	ND	ND	ND	ND	ND	4.18E+02	ND	0.00E+00	2.59E-03	3.47E-02	-1.95E-03	-1.79E+00
Non-re. PER as energy	MJ	9.38E+01	7.88E-01	7.14E+00	1.02E+02	1.86E+00	4.54E-02	ND	ND	ND	ND	ND	1.52E+03	ND	0.00E+00	1.89E-01	-1.50E+00	-2.71E+00	-1.67E+01
Non-re. PER as material	MJ	4.05E+00	0.00E+00	-2.85E-01	3.76E+00	0.00E+00	-3.56E-05	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	-1.87E+00	-1.89E+00	0.00E+00
Total use of non-re. PER	MJ	9.78E+01	7.88E-01	6.85E+00	1.05E+02	1.86E+00	4.54E-02	ND	ND	ND	ND	ND	1.52E+03	ND	0.00E+00	1.89E-01	-3.37E+00	-4.60E+00	-1.67E+01
Secondary materials	kg	5.26E-02	0.00E+00	0.00E+00	5.26E-02	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renew. secondary fuels	MJ	7.66E-03	4.26E-06	1.99E-04	7.87E-03	4.05E-06	5.65E-07	ND	ND	ND	ND	ND	2.01E-03	ND	0.00E+00	1.08E-06	1.15E-05	1.08E-06	-1.96E-04
Non-ren. secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water	m^3	6.01E-02	1.17E-04	8.22E-03	6.84E-02	1.65E-04	8.52E-05	ND	ND	ND	ND	ND	1.32E+00	ND	0.00E+00	2.50E-05	2.52E-04	-1.32E-04	-2.41E-02

8) PER = Primary energy resources.

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste	kg	1.01E+00	1.34E-03	8.48E-03	1.02E+00	2.65E-03	1.38E-03	ND	ND	ND	ND	ND	3.85E+00	ND	0.00E+00	3.29E-04	3.69E-03	4.71E-02	-4.50E-01
Non-hazardous waste	kg	2.29E+01	2.47E-02	6.82E-01	2.36E+01	3.98E-02	7.49E-02	ND	ND	ND	ND	ND	2.98E+02	ND	0.00E+00	6.17E-03	9.63E-02	4.56E-01	-2.14E+01
Radioactive waste	kg	1.38E-04	1.68E-07	1.96E-06	1.40E-04	2.54E-07	1.38E-08	ND	ND	ND	ND	ND	1.08E-02	ND	0.00E+00	3.74E-08	5.15E-07	1.98E-08	-2.88E-05

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	0.00E+00	0.00E+00	3.01E-02	3.01E-02	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	1.42E-01	0.00E+00	0.00E+00
Materials for energy rec	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	5.52E-01	0.00E+00	0.00E+00
Exported energy – Electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	2.32E-01	0.00E+00	0.00E+00
Exported energy – Heat	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	3.19E-01	0.00E+00	0.00E+00

ENVIRONMENTAL IMPACTS – EN 15804+A1, CML

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Global Warming Pot.	kg CO_2e	7.40E+00	5.40E-02	7.33E-01	8.19E+00	1.45E-01	4.36E-03	ND	ND	ND	ND	ND	6.55E+01	ND	0.00E+00	1.34E-02	1.34E-01	6.46E-02	-1.53E+00
Ozone depletion Pot.	kg CFC_{-11}e	1.49E-07	6.40E-10	6.10E-09	1.56E-07	1.68E-09	5.13E-11	ND	ND	ND	ND	ND	1.01E-06	ND	0.00E+00	1.50E-10	1.58E-10	7.24E-11	-7.42E-09
Acidification	kg SO_2e	6.21E-02	1.41E-04	3.01E-03	6.53E-02	2.73E-03	1.92E-05	ND	ND	ND	ND	ND	3.28E-01	ND	0.00E+00	3.44E-05	1.19E-04	2.42E-05	-5.82E-02
Eutrophication	kg PO_4^3e	1.46E-02	3.45E-05	7.30E-04	1.53E-02	3.11E-04	5.96E-06	ND	ND	ND	ND	ND	4.24E-02	ND	0.00E+00	8.36E-06	2.05E-05	1.37E-05	-2.36E-03
POCP (“smog”)	kg C_2H_4e	5.25E-03	1.26E-05	1.48E-04	5.41E-03	1.39E-04	1.46E-06	ND	ND	ND	ND	ND	1.79E-02	ND	0.00E+00	3.08E-06	6.91E-06	2.67E-06	-2.55E-03
ADP-elements	kg Sbe	9.43E-04	1.48E-07	6.00E-07	9.44E-04	1.99E-07	1.09E-08	ND	ND	ND	ND	ND	8.81E-04	ND	0.00E+00	4.31E-08	3.68E-07	1.01E-08	-8.95E-04
ADP-fossil	MJ	8.89E+01	7.78E-01	8.75E+00	9.84E+01	1.85E+00	4.45E-02	ND	ND	ND	ND	ND	7.82E+02	ND	0.00E+00	1.86E-01	2.22E-01	6.86E-02	-1.49E+01

ADDITIONAL INDICATOR – GWP-GHG

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-GHG 9)	kg CO2e	7.46E+00	5.44E-02	7.99E-01	8.31E+00	1.46E-01	1.16E-01	ND	ND	ND	ND	ND	6.58E+01	ND	0.00E+00	1.35E-02	1.34E-01	6.51E-02	-1.54E+00

9) This indicator includes all greenhouse gases excluding biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. In addition, the characterisation factors for the flows - CH4 fossil, CH4 biogenic and Dinitrogen monoxide - were updated. This indicator is identical to the GWP-total of EN 15804:2012+A2:2019 except that the characterization factor for biogenic CO2 is set to zero.

ENVIRONMENTAL IMPACT DATA, RESULTS PER FUNCTIONAL UNIT

The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP – total[1)]	kg CO_2 éq/FU	1.30E+01	9.51E-02	1.20E+00	1.42E+01	2.56E-01	1.97E-01	ND	ND	ND	ND	ND	1.15E+02	ND	0.00E+00	2.36E-02	2.34E-01	1.14E-01	-2.70E+00
GWP – fossil	kg CO_2 éq/FU	1.30E+01	9.51E-02	1.29E+00	1.44E+01	2.56E-01	7.69E-03	ND	ND	ND	ND	ND	1.15E+02	ND	0.00E+00	2.36E-02	2.34E-01	1.14E-01	-2.69E+00
GWP – biogenic	kg CO_2 éq/FU	-8.24E-02	2.15E-05	-8.49E-02	-1.67E-01	4.40E-05	1.89E-01	ND	ND	ND	ND	ND	2.57E-01	ND	0.00E+00	5.14E-06	-3.37E-06	1.56E-05	-2.70E-03
GWP – LULUC	kg CO_2 éq/FU	2.04E-02	4.25E-05	7.56E-04	2.12E-02	1.33E-04	2.84E-06	ND	ND	ND	ND	ND	3.52E-01	ND	0.00E+00	1.04E-05	5.92E-05	7.61E-06	-2.27E-03
Ozone depletion pot.	kg CFC_{11}e/FU	2.66E-07	1.40E-09	1.26E-08	2.80E-07	3.69E-09	1.06E-10	ND	ND	ND	ND	ND	2.11E-06	ND	0.00E+00	3.29E-10	3.22E-10	1.54E-10	-1.47E-08
Acidification potential	mole H^+e/FU	1.28E-01	3.24E-04	6.17E-03	1.34E-01	5.99E-03	4.57E-05	ND	ND	ND	ND	ND	6.74E-01	ND	0.00E+00	7.85E-05	2.60E-04	5.82E-05	-1.16E-01
EP-freshwater[2)]	kg Pe/FU	9.57E-03	7.40E-06	2.74E-04	9.85E-03	1.07E-05	7.72E-07	ND	ND	ND	ND	ND	1.07E-01	ND	0.00E+00	1.83E-06	1.61E-05	1.01E-06	-6.28E-03
EP-marine	kg Ne/FU	1.62E-02	1.07E-04	9.59E-04	1.72E-02	1.51E-03	2.13E-05	ND	ND	ND	ND	ND	1.06E-01	ND	0.00E+00	2.54E-05	6.83E-05	2.16E-04	-5.99E-03
EP-terrestrial	mol Ne/FU	1.74E-01	1.16E-03	8.96E-03	1.84E-01	1.67E-02	1.94E-04	ND	ND	ND	ND	ND	9.47E-01	ND	0.00E+00	2.77E-04	6.86E-04	2.57E-04	-7.69E-02
POCP ("smog")[3)]	kg NMVOCe/	6.34E-02	4.78E-04	3.84E-03	6.77E-02	4.63E-03	5.53E-05	ND	ND	ND	ND	ND	3.12E-01	ND	0.00E+00	1.09E-04	1.89E-04	7.86E-05	-2.30E-02
ADP-minerals & metals[4)]	kg Sbe/FU	1.65E-03	2.65E-07	1.09E-06	1.65E-03	3.55E-07	2.29E-08	ND	ND	ND	ND	ND	1.55E-03	ND	0.00E+00	7.73E-08	6.50E-07	2.05E-08	-1.57E-03
ADP-fossil resources	MJ/FU	1.71E+02	1.38E+00	1.56E+01	1.88E+02	3.26E+00	7.95E-02	ND	ND	ND	ND	ND	2.67E+03	ND	0.00E+00	3.30E-01	4.48E-01	1.22E-01	-2.92E+01
Water use[5)]	m^3e priv. /FU	4.03E+00	6.82E-03	7.48E+00	1.15E+01	1.09E-02	9.20E-03	ND	ND	ND	ND	ND	7.27E+01	ND	0.00E+00	1.53E-03	2.09E-02	7.41E-03	-7.81E-01

1) GWP = Global Warming Potential. 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO4e. 3) POCP = Photochemical ozone formation. 4) ADP = Abiotic depletion potential. 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Particulate matter	Incidence /FU	9.53E-07	9.52E-09	1.84E-08	9.81E-07	1.17E-08	5.69E-10	ND	ND	ND	ND	ND	2.40E-06	ND	0.00E+00	1.87E-09	2.55E-09	9.45E-10	-2.68E-07
Ionizing radiation[6)]	kBq U235e/FU	9.73E-01	1.20E-03	1.88E-02	9.93E-01	1.82E-03	9.63E-05	ND	ND	ND	ND	ND	7.37E+01	ND	0.00E+00	2.67E-04	3.68E-03	1.40E-04	-2.02E-01
Ecotoxicity (freshwater)	CTUe/FU	2.10E+02	1.95E-01	2.79E+00	2.13E+02	2.98E-01	2.20E-01	ND	ND	ND	ND	ND	4.06E+02	ND	0.00E+00	5.22E-02	5.29E-01	3.92E+00	-9.01E+01
Human toxicity, cancer	CTUh/FU	1.09E-08	1.57E-11	1.55E-10	1.11E-08	5.14E-11	1.06E-11	ND	ND	ND	ND	ND	3.87E-08	ND	0.00E+00	4.00E-12	3.15E-11	4.16E-11	-1.40E-08
Human tox. non-cancer	CTUh/FU	5.01E-07	8.93E-10	7.09E-09	5.09E-07	1.14E-09	4.33E-10	ND	ND	ND	ND	ND	2.01E-06	ND	0.00E+00	2.07E-10	1.74E-09	1.86E-09	-1.41E-06
SQP[7)]	-/FU	6.52E+01	1.39E+00	1.48E+01	8.14E+01	1.04E+00	3.89E-02	ND	ND	ND	ND	ND	5.93E+02	ND	0.00E+00	1.97E-01	2.65E-01	2.09E-01	-3.75E+01

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renew. PER as energy[8)]	MJ/FU	1.78E+01	1.89E-02	-2.13E-01	1.76E+01	3.01E-02	-2.18E+00	ND	ND	ND	ND	ND	7.31E+02	ND	0.00E+00	4.53E-03	6.09E-02	-5.71E-04	-3.12E+00
Renew. PER as material	MJ/FU	9.39E-01	0.00E+00	1.02E+00	1.96E+00	0.00E+00	-1.95E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	-2.76E-04	-2.85E-03	0.00E+00
Total use of renew. PER	MJ/FU	1.88E+01	1.89E-02	8.04E-01	1.96E+01	3.01E-02	-4.13E+00	ND	ND	ND	ND	ND	7.31E+02	ND	0.00E+00	4.53E-03	6.07E-02	-3.42E-03	-3.12E+00
Non-re. PER as energy	MJ/FU	1.64E+02	1.38E+00	1.25E+01	1.78E+02	3.26E+00	7.95E-02	ND	ND	ND	ND	ND	2.67E+03	ND	0.00E+00	3.30E-01	-2.63E+00	-4.74E+00	-2.92E+01
Non-re. PER as material	MJ/FU	7.08E+00	0.00E+00	-4.99E-01	6.58E+00	0.00E+00	-6.23E-05	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	-3.27E+00	-3.31E+00	0.00E+00
Total use of non-re. PER	MJ/FU	1.71E+02	1.38E+00	1.20E+01	1.85E+02	3.26E+00	7.94E-02	ND	ND	ND	ND	ND	2.67E+03	ND	0.00E+00	3.30E-01	-5.90E+00	-8.05E+00	-2.92E+01
Secondary materials	kg/FU	9.20E-02	0.00E+00	0.00E+00	9.20E-02	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renew. secondary fuels	MJ/FU	1.34E-02	7.46E-06	3.49E-04	1.38E-02	7.09E-06	9.89E-07	ND	ND	ND	ND	ND	3.52E-03	ND	0.00E+00	1.89E-06	2.01E-05	1.89E-06	-3.42E-04
Non-ren. secondary fuels	MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water	m^3/FU	1.05E-01	2.04E-04	1.44E-02	1.20E-01	2.89E-04	1.49E-04	ND	ND	ND	ND	ND	2.30E+00	ND	0.00E+00	4.38E-05	4.41E-04	-2.31E-04	-4.22E-02

8) PER = Primary energy resources.

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste	kg/FU	1.77E+00	2.34E-03	1.48E-02	1.78E+00	4.63E-03	2.42E-03	ND	ND	ND	ND	ND	6.74E+00	ND	0.00E+00	5.76E-04	6.45E-03	8.24E-02	-7.88E-01
Non-hazardous waste	kg/FU	4.00E+01	4.33E-02	1.19E+00	4.13E+01	6.97E-02	1.31E-01	ND	ND	ND	ND	ND	5.22E+02	ND	0.00E+00	1.08E-02	1.69E-01	7.99E-01	-3.75E+01
Radioactive waste	kg/FU	2.41E-04	2.94E-07	3.43E-06	2.44E-04	4.45E-07	2.41E-08	ND	ND	ND	ND	ND	1.89E-02	ND	0.00E+00	6.55E-08	9.01E-07	3.46E-08	-5.05E-05

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	0.00E+00	0.00E+00	5.26E-02	5.26E-02	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	2.49E-01	0.00E+00	0.00E+00
Materials for energy rec	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	9.66E-01	0.00E+00	0.00E+00
Exported energy – Electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	4.07E-01	0.00E+00	0.00E+00
Exported energy – Heat	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	ND	ND	ND	0.00E+00	ND	0.00E+00	0.00E+00	5.59E-01	0.00E+00	0.00E+00

ENVIRONMENTAL IMPACTS – EN 15804+A1, CML

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Global Warming Pot.	kg CO_2 éq./FU	1.29E+01	9.46E-02	1.28E+00	1.43E+01	2.54E-01	7.62E-03	ND	ND	ND	ND	ND	1.15E+02	ND	0.00E+00	2.34E-02	2.34E-01	1.13E-01	-2.68E+00
Ozone depletion Pot.	kg CFC-$_{11}$e/FU	2.61E-07	1.12E-09	1.07E-08	2.73E-07	2.93E-09	8.98E-11	ND	ND	ND	ND	ND	1.76E-06	ND	0.00E+00	2.63E-10	2.76E-10	1.27E-10	-1.30E-08
Acidification	kg SO_2e/FU	1.09E-01	2.48E-04	5.27E-03	1.14E-01	4.77E-03	3.36E-05	ND	ND	ND	ND	ND	5.74E-01	ND	0.00E+00	6.01E-05	2.08E-04	4.23E-05	-1.02E-01
Eutrophication	kg PO_4^3e/FU	2.55E-02	6.03E-05	1.28E-03	2.68E-02	5.44E-04	1.04E-05	ND	ND	ND	ND	ND	7.42E-02	ND	0.00E+00	1.46E-05	3.59E-05	2.39E-05	-4.13E-03
POCP (“smog”)	kg C_2H_4e/FU	9.18E-03	2.21E-05	2.59E-04	9.46E-03	2.43E-04	2.56E-06	ND	ND	ND	ND	ND	3.13E-02	ND	0.00E+00	5.38E-06	1.21E-05	4.67E-06	-4.46E-03
ADP-elements	kg Sbe/FU	1.65E-03	2.59E-07	1.05E-06	1.65E-03	3.49E-07	1.91E-08	ND	ND	ND	ND	ND	1.54E-03	ND	0.00E+00	7.55E-08	6.43E-07	1.78E-08	-1.57E-03
ADP-fossil	MJ/FU	1.56E+02	1.36E+00	1.53E+01	1.72E+02	3.23E+00	7.80E-02	ND	ND	ND	ND	ND	1.37E+03	ND	0.00E+00	3.26E-01	3.89E-01	1.20E-01	-2.61E+01

ADDITIONAL INDICATOR – GWP-GHG

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-GHG [9]	kg CO_2e/FU	1.31E+01	9.51E-02	1.40E+00	1.45E+01	2.56E-01	2.03E-01	ND	ND	ND	ND	ND	1.15E+02	ND	0.00E+00	2.36E-02	2.35E-01	1.14E-01	-2.70E+00

9) This indicator includes all greenhouse gases excluding biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. In addition, the characterisation factors for the flows - CH4 fossil, CH4 biogenic and Dinitrogen monoxide - were updated. This indicator is identical to the GWP-total of EN 15804:2012+A2:2019 except that the characterization factor for biogenic CO2 is set to zero.

SCENARIO DOCUMENTATION
DATA SOURCES

Manufacturing energy scenario documentation – A3 (Energy data source)

1. Electricity, Electricity, consumption mix w/o renewables, China, 2023, China, LCA study for country specific consumption mixes, OneClickLCA 2025, 1.15 kgCO2e/kWh
2. Energy supply, electricity production, co-generation oil and gas, Heat and power co-generation, natural gas, combined cycle power plant, 400MW electrical, World, ecoinvent 3.10.1, 0.0307 kgCO2e/MJ
3. Construction, specialized activities, demolition and site preparation, Market for diesel, burned in building machine, World, ecoinvent 3.10.1, 0.10 kgCO2e/MJ
4. Manufacturing, chemicals and chemical products, general chemicals, Market for propane, World, ecoinvent 3.10.1, 1.13 kgCO2e/kg

Transport scenario documentation - A4

1. Transport, freight, lorry >32 metric ton, EURO5, 590.13 km
2. Transport, freight, sea, container ship, 20762.28 km

Installation scenario documentation - A5 (Waste materials data source)

1. Containerboard production, linerboard, kraftliner, 0.0399 kg
2. Containerboard production, fluting medium, semichemical, 0.0301 kg
3. Market for printed paper, offset, 1.0E-4 kg

Use stages scenario documentation - B6-B7 (Energy data source)

1. Energy supply, electricity transformation and distribution, distribution low voltage, Market group for electricity, low voltage, Europe, 200.0 kWh

TRANSPORT SCENARIO DOCUMENTATION - A4

Scenario parameter	Value
Capacity utilization (including empty return) %	50 %
Bulk density of transported products / kg/m3	401
Volume capacity utilization factor (factor: =1 or <1 or ≥1 for compressed or nested packaged products)	1

INSTALLATION SCENARIO DOCUMENTATION - A5

Scenario parameter	Value
Ancillary materials for installation (specified by material) / kg or other units as appropriate	0
Water use / m³	0
Other resource use / kg	0
Direct emissions to ambient air, soil and water / kg	0

USE STAGES SCENARIO DOCUMENTATION - B6-B7 USE OF ENERGY AND WATER

Scenario information	Value
Ancillary materials specified by material / kg or units as appropriate	Not applicable
Net fresh water consumption / m^3	0
Power output of equipment / kW	4
Characteristic performance, e.g., energy efficiency, emissions, variation of performance with capacity utilization, etc. / Units as appropriate	For more details see product classification table and product description.
Further assumptions for scenario development, e.g., frequency and period of use, number of occupants / Units as appropriate	For more details see product classification table and product description.

END OF LIFE SCENARIO DOCUMENTATION

Scenario information	Value
Collection process – kg collected separately	0.459
Collection process – kg collected with mixed waste	0
Recovery process – kg for re-use	0
Recovery process – kg for recycling	0.14
Recovery process – kg for energy recovery	0
Disposal (total) – kg for final deposition	0.26
Scenario assumptions e.g. transportation	Lorry, 16-32 metric ton, EURO5; 150 km

THIRD-PARTY VERIFICATION STATEMENT

EPD Hub declares that this EPD is verified in accordance with ISO 14025 by an independent, third-party verifier. The project report on the Life Cycle Assessment and the report(s) on features of environmental relevance are filed at EPD Hub. EPD Hub PCR and ECO Platform verification checklist are used.

EPD Hub is not able to identify any unjustified deviations from the PCR and EN 15804+A2 in the Environmental Product Declaration and its project report.

EPD Hub maintains its independence as a third-party body; it was not involved in the execution of the LCA or in the development of the declaration and has no conflicts of interest regarding this verification.

The company-specific data and upstream and downstream data have been examined as regards plausibility and consistency. The publisher is responsible for ensuring the factual integrity and legal compliance of this declaration.



Program assistant: Xinyuan Zhang

The software used in creation of this LCA and EPD is verified by EPD Hub to conform to the procedural and methodological requirements outlined in ISO 14025:2010, ISO 14040/14044, EN 15804+A2, and EPD Hub Core Product Category Rules and General Program Instructions.

Verified tools
Tool verifier: Hai Ha Nguyen
Tool verification validity: 28 March 2025 - 27 March 2028