

ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025

SPIDI MAX WALL BRACKET (EN-5052, A2 1.4301, S250GD)

From

SLAVONIA BAUBEDARF GMBH



Programme operator: Rakennustieto Oy

EPD registration number RTS_403_25

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GENERAL INFORMATION

MANUFACTURER

Manufacturer	Slavonia Baubedarf GmbH
Address	Hauffgasse 3-5, A-1110 Vienna, Austria
Contact details	office@slavonia.com
Website	https://slavonia.com/en/

EPD STANDARDS, SCOPE AND VERIFICATION

Program operator	Rakennustieto Oy
Reference standard	This EPD is in accordance with EN 15804+A2:2019 and ISO 14025 standards
PCR	The CEN standard EN 15804 serves as the core PCR. In addition, the RTS PCR (English version, 12.11.24) is used
Sector	Construction product
Category of EPD	Third party verified EPD
Scope of the EPD	Cradle to gate with options, A5, and modules C1-C4, D
EPD author	Marianne Aru, LCA Support
EPD verification	Independent verification of this EPD and data, according to ISO 14025: ☐ Internal verification ☒ External verification
EPD verifier	Sigita Židonienė, Vesta Consulting, UAB

This EPD is intended for business-to-business and/or business-to-consumer communication. 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

Product name	SPIDI max wall bracket
Place of production	Austria
Period for data	Calendar year 2023
Averaging in EPD	No averaging

This EPD covers SPIDI max wall brackets with three variations:

1. Aluminium EN-AW 5052-H12;
2. Stainless steel A2 1.4301;
3. Galvanised steel S250GD.

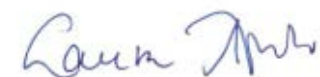
BIOGENIC CARBON CONTENT

Product's biogenic carbon content at the factory gate

	EN-5052	A2 1.4301	S250GD
Biogenic carbon content in product, kg C	0	0	0
Biogenic carbon content in packaging, kg C	0,057	0,0201	0,0210



Jukka Seppänen
RTS EPD Committee Secretary



Laura Apilo
Managing Director

PRODUCT AND MANUFACTURER

ABOUT THE MANUFACTURER

Our production brings together 30 years of metal manufacturing expertise in Austria. Specializing in the development and production of stamped and bent parts in both small and large series – from manufacturing metal stamped parts to processing complex assemblies – allowing to respond reliably and flexibly to the requirements of all building construction sectors.

PRODUCT DESCRIPTION

The patented SPIDI® max wall brackets are ETA-approved and available in lengths from 40 mm to 900 mm. They are made of aluminum, steel with additional cathodic dip coating for enhanced corrosion protection and stainless steel A2. The stainless steel brackets are also passive house certified. All brackets have a 6 mm pre-assembled thermostop, can be used as a fixed and sliding point and can be installed both horizontally and vertically.

Further information can be found at <https://slavonia.com/en/>.

PRODUCT APPLICATION

SPIDI max wall brackets are used in substructure systems for ventilated facades (rainscreen claddings).

TECHNICAL SPECIFICATIONS AND PRODUCT STANDARDS

Wall brackets produced by Slavonia Baubedarf GmbH are available in lengths from 40-1500mm and 1.5 and 2.0mm thickness.

Metal grade: Aluminium EN-AW 5052-H12; Steel S250GD; Stainless steel A2 1.4301.

Product CPC code: 42127.

Weight of 1 piece of Product depending on metal variation:

- Aluminium EN-AW 5052-H12 – 0.2180 kg
- Stainless steel A2 1.4301 – 0.6430 kg
- Galvanised steel S250GD – 0.6430 kg

These products are manufactured according to European standards:

- EN 1090-2 - Execution of steel structures and aluminium structures - Part 2: Technical requirements for steel structures
- EN 1090-3 - Execution of steel structures and aluminium structures - Part 3: Technical requirements for aluminium structures

PRODUCT RAW MATERIAL MAIN COMPOSITION (EN-5052)

Raw material category	Amount, mass %	Recycled material, %	Material origin
Metals	92	5	Europe
Minerals	0	-	-
Fossil materials	8	0	Europe
Bio-based materials	0	-	-

PRODUCT RAW MATERIAL MAIN COMPOSITION (A2 1.4301)

Raw material category	Amount, mass %	Recycled material, %	Material origin
Metals	97	5	Europe
Minerals	0	-	-
Fossil materials	3	0	Europe
Bio-based materials	0	-	-

PRODUCT RAW MATERIAL MAIN COMPOSITION (S250GD)

Raw material category	Amount, mass %	Recycled material, %	Material origin
Metals	97	5	Europe
Minerals	0	-	-
Fossil materials	3	0	Europe
Bio-based materials	0	-	-

FUNCTIONAL UNIT AND SERVICE LIFE

Declared unit	one kilogram of product
Mass of one piece of EN-5052 product variation	0.2180 kg
Mass of one piece of A2-1.4301 product variation	0.6430 kg
Mass of one piece of S250GD product variation	0.6430 kg

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

SYSTEM BOUNDARY

This EPD covers the cradle to gate with options scope with following modules: A1 (Raw material supply), A2 (Transport), A3 (Manufacturing), A5 (Assembly), C1 (Deconstruction), C2 (Transport at end-of-life), C3 (Waste processing), C4 (Disposal) and D - benefits and loads beyond the system boundary. The life-cycle modules covered by this EPD are listed in the following table.

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries		
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D		
x	x	x	MND	x	MND	MND	MND	MND	MND	MND	MND	x	x	x	x	x		
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/ demolition	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling

Modules not declared = MND. Modules not relevant = MNR

MANUFACTURING AND PACKAGING (A1-A3)

The environmental impacts considered for the product stage cover the manufacturing of raw materials used in the production as well as packaging materials and other ancillary materials. Also, fuels used by machines, and handling of waste formed in the production processes at the manufacturing facilities are included in this stage. The study also considers the material

losses occurring during the manufacturing processes as well as losses during electricity transmission.

SPIDI max wall brackets are formed from aluminum, steel, or stainless steel coils using a multi-stage forming tool to create SPIDI Max brackets. For steel brackets, a KTL coating is additionally applied to ensure optimal corrosion protection. The finished brackets are then press-fitted with the injection-molded thermostop. The final products are carefully packed into cartons, wrapped in plastic film and prepared for delivery on pallets.

The use of green energy in manufacturing is demonstrated through contractual instruments (GOs, RECs, etc.), and its use is ensured throughout the validity period of this EPD. The electricity mix consists of hydropower (53,13%), wind energy (5,68%), solar power (1,15%), biogas (1,48%) and solid or liquid biomass (38,56%). Natural gas is used for heating during winter. In addition, the Manufacturer has solar panels installed on the roof to produce electricity locally.

TRANSPORT AND INSTALLATION (A4-A5)

A4 has not been declared. A4 has not been declared because GWP data does not exceed 20% of the total GWP and the average transportation distance is under 1000 km (RTS PCR).

Installation in module A5 is assumed to be done by hand requiring no additional energy. Module A5 includes the end-of-life treatment of packaging materials. It is assumed that cardboard packaging will be recycled whereas plastic and wood packaging will be incinerated with energy recovery. Strapping tape and labels are excluded by cut-off. The average transportation distance to the waste treatment facility is assumed to be 50 km from the installation site.

PRODUCT USE AND MAINTENANCE (B1-B7)

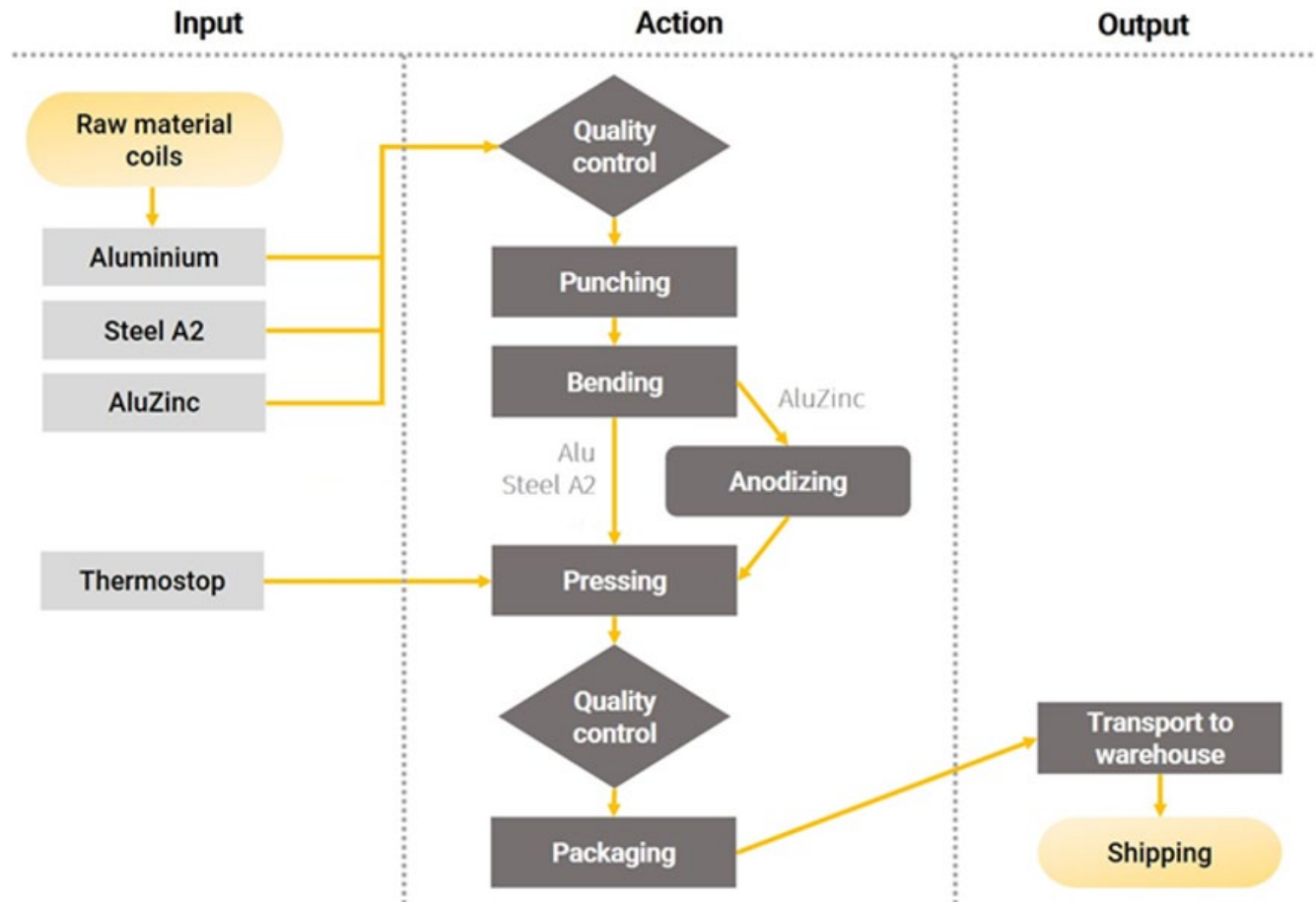
This EPD does not cover the use phase.

Air, soil, and water impacts during the use phase have not been studied.

PRODUCT END OF LIFE (C1-C4, D)

It is assumed that 100% of the waste is collected and deconstruction will be done by hand. Distance for transportation to treatment or landfill is assumed as 50 km and the transportation method is assumed to be lorry (C2). 90% of steel is assumed to be recycled based on EuRIC (2020). This scrap steel is used as input for electric arc furnaces (C3). 81% of aluminium is assumed to be recycled based on International Aluminium Institute (2020). This scrap aluminium is used as input for reverberatory furnaces (C3). The remaining 19% of aluminium and 10% of steel is assumed to be taken to landfill for final disposal (C4). Net benefits and loads from recycled steel are reflected in module D. Module D scenario is representative of Europe.

MANUFACTURING PROCESS



LIFE-CYCLE ASSESSMENT

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. The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. 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.

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/AC2021 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, allocation has been done in the following ways:

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

AVERAGES AND VARIABILITY

Type of average	No averaging
Averaging method	Not applicable

This EPD is product and factory specific and does not contain average calculations.

LCA SOFTWARE AND BIBLIOGRAPHY

This EPD has been created using One Click LCA EPD Generator. The LCA and EPD have been prepared according to the reference standards and ISO 14040/14044. The EPD Generator uses Ecoinvent v3.10.1 and One Click LCA databases as sources of environmental data. Allocation used in Ecoinvent 3.10.1 environmental data sources follow the methodology 'allocation, Cut-off, EN 15804+A2'. This EPD has been created in accordance with RTS Environmental Product Declaration (EPD) Guideline (RTS EPD No. 180221) and RTS Product Category Rules (PCR), English version (12.11.24). Metal recycling information has been taken from EuRIC Metal Recycling Factsheet. European Circular Economy Stakeholder Platform (2020) and International Aluminium Institute (2020).

ENVIRONMENTAL IMPACT DATA

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2 FOR EN-5052 PRODUCT VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP – total ¹⁾	kg CO ₂ e	6,19E+00	2,24E-02	4,61E-01	6,68E+00	MND	2,27E-01	0,00E+00	5,38E-03	3,44E-01	1,75E-03	-4,04E+00
GWP – fossil	kg CO ₂ e	6,04E+00	2,24E-02	4,92E-01	6,56E+00	MND	7,18E-03	0,00E+00	5,38E-03	3,44E-01	1,75E-03	-3,94E+00
GWP – biogenic	kg CO ₂ e	2,49E-02	5,07E-06	-1,93E-01	-1,68E-01	MND	2,19E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
GWP – LULUC	kg CO ₂ e	1,25E-01	1,00E-05	1,62E-01	2,87E-01	MND	2,16E-06	0,00E+00	2,41E-06	8,00E-05	4,82E-07	-9,27E-02
Ozone depletion pot.	kg CFC ₋₁₁ e	1,03E-07	3,30E-10	1,44E-08	1,18E-07	MND	3,18E-11	0,00E+00	7,95E-11	1,50E-09	5,48E-11	-7,16E-08
Acidification potential	mol H ⁺ e	3,71E-02	7,63E-05	5,89E-03	4,31E-02	MND	2,25E-05	0,00E+00	1,84E-05	5,81E-04	1,93E-05	-2,39E-02
EP-freshwater ²⁾	kg Pe	3,17E-03	1,74E-06	1,70E-04	3,34E-03	MND	1,02E-06	0,00E+00	4,19E-07	4,17E-05	2,94E-06	-2,12E-03
EP-marine	kg Ne	5,26E-03	2,51E-05	1,54E-03	6,83E-03	MND	1,09E-05	0,00E+00	6,03E-06	9,08E-05	4,81E-06	-3,30E-03
EP-terrestrial	mol Ne	4,87E-02	2,73E-04	2,29E-02	7,18E-02	MND	8,96E-05	0,00E+00	6,56E-05	9,53E-04	5,17E-05	-2,98E-02
POCP (“smog”) ³⁾	kg NMVOCe	2,15E-02	1,12E-04	5,78E-03	2,74E-02	MND	2,56E-05	0,00E+00	2,70E-05	3,05E-04	1,89E-05	-1,34E-02
ADP-minerals & metals ⁴⁾	kg Sbe	1,51E-05	6,24E-08	7,51E-06	2,27E-05	MND	2,22E-08	0,00E+00	1,50E-08	3,99E-06	3,43E-09	4,13E-06
ADP-fossil resources	MJ	9,83E+01	3,25E-01	8,24E+00	1,07E+02	MND	3,47E-02	0,00E+00	7,81E-02	1,01E+00	4,07E-02	-6,21E+01
Water use ⁵⁾	m ³ e depr.	1,05E+01	1,60E-03	5,43E+00	1,59E+01	MND	2,64E-03	0,00E+00	3,86E-04	3,50E-02	2,46E-04	-7,67E+00

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.

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2 FOR A2 1.4301 PRODUCT VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP – total ¹⁾	kg CO ₂ e	5,29E+00	8,57E-03	5,08E-01	5,80E+00	MND	7,95E-02	0,00E+00	5,39E-03	8,78E-02	6,07E-04	-5,27E-01
GWP – fossil	kg CO ₂ e	5,28E+00	8,56E-03	3,97E-01	5,68E+00	MND	2,56E-03	0,00E+00	5,38E-03	8,78E-02	6,06E-04	-5,27E-01
GWP – biogenic	kg CO ₂ e	6,53E-03	1,94E-06	-5,06E-02	-4,41E-02	MND	7,69E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
GWP – LULUC	kg CO ₂ e	5,28E-03	3,83E-06	1,61E-01	1,66E-01	MND	6,95E-07	0,00E+00	2,41E-06	2,49E-05	3,47E-07	-5,54E-04
Ozone depletion pot.	kg CFC-11e	3,73E-08	1,26E-10	1,22E-08	4,96E-08	MND	1,15E-11	0,00E+00	7,95E-11	2,91E-10	1,76E-11	-4,58E-09
Acidification potential	mol H ⁺ e	2,86E-02	2,92E-05	5,36E-03	3,40E-02	MND	8,15E-06	0,00E+00	1,84E-05	2,51E-04	4,30E-06	-2,17E-03
EP-freshwater ²⁾	kg Pe	1,67E-03	6,67E-07	1,30E-04	1,80E-03	MND	3,60E-07	0,00E+00	4,19E-07	1,29E-05	4,99E-08	-9,27E-05
EP-marine	kg Ne	5,21E-03	9,59E-06	1,41E-03	6,63E-03	MND	3,99E-06	0,00E+00	6,03E-06	6,09E-05	1,64E-06	-5,39E-04
EP-terrestrial	mol Ne	5,54E-02	1,04E-04	2,16E-02	7,72E-02	MND	3,39E-05	0,00E+00	6,56E-05	6,63E-04	1,79E-05	-5,80E-03
POCP (“smog”) ³⁾	kg NMVOCe	1,78E-02	4,30E-05	5,36E-03	2,32E-02	MND	9,54E-06	0,00E+00	2,70E-05	1,93E-04	6,41E-06	-2,12E-03
ADP-minerals & metals ⁴⁾	kg Sbe	1,23E-04	2,39E-08	7,11E-06	1,30E-04	MND	6,95E-09	0,00E+00	1,50E-08	1,41E-06	9,63E-10	-4,16E-07
ADP-fossil resources	MJ	6,03E+01	1,24E-01	6,65E+00	6,70E+01	MND	1,21E-02	0,00E+00	7,81E-02	2,78E-01	1,49E-02	-5,02E+00
Water use ⁵⁾	m ³ e depr.	1,62E+00	6,14E-04	5,37E+00	7,00E+00	MND	1,06E-03	0,00E+00	3,86E-04	9,25E-03	4,29E-05	-2,95E-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.

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2 FOR S250GD PRODUCT VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP – total ¹⁾	kg CO ₂ e	2,04E+00	4,43E-02	7,63E-01	2,85E+00	MND	8,30E-02	0,00E+00	5,39E-03	9,14E-02	6,06E-04	-1,12E+00
GWP – fossil	kg CO ₂ e	2,04E+00	4,42E-02	7,28E-01	2,81E+00	MND	2,62E-03	0,00E+00	5,38E-03	9,14E-02	6,05E-04	-1,12E+00
GWP – biogenic	kg CO ₂ e	1,59E-03	1,00E-05	-1,27E-01	-1,26E-01	MND	8,04E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
GWP – LULUC	kg CO ₂ e	1,30E-03	1,98E-05	1,62E-01	1,63E-01	MND	7,83E-07	0,00E+00	2,41E-06	2,49E-05	3,46E-07	-1,44E-04
Ozone depletion pot.	kg CFC-11e	1,86E-08	6,53E-10	1,64E-08	3,56E-08	MND	1,17E-11	0,00E+00	7,95E-11	2,92E-10	1,75E-11	-5,92E-09
Acidification potential	mol H ⁺ e	2,16E-02	1,51E-04	7,47E-03	2,92E-02	MND	8,25E-06	0,00E+00	1,83E-05	2,51E-04	4,29E-06	-4,25E-03
EP-freshwater ²⁾	kg Pe	9,42E-04	3,44E-06	1,69E-03	2,64E-03	MND	3,73E-07	0,00E+00	4,19E-07	1,29E-05	4,98E-08	-4,66E-04
EP-marine	kg Ne	2,23E-03	4,96E-05	2,33E-02	2,56E-02	MND	4,00E-06	0,00E+00	6,03E-06	6,13E-05	1,64E-06	-9,51E-04
EP-terrestrial	mol Ne	7,87E-02	5,39E-04	2,84E-02	1,08E-01	MND	3,30E-05	0,00E+00	6,56E-05	6,66E-04	1,79E-05	-1,04E-02
POCP (“smog”) ³⁾	kg NMVOCe	6,74E-03	2,22E-04	6,68E-03	1,36E-02	MND	9,43E-06	0,00E+00	2,70E-05	1,94E-04	6,40E-06	-3,58E-03
ADP-minerals & metals ⁴⁾	kg Sbe	5,54E-05	1,23E-07	9,10E-06	6,47E-05	MND	8,02E-09	0,00E+00	1,50E-08	1,40E-06	9,62E-10	-1,03E-05
ADP-fossil resources	MJ	2,50E+01	6,42E-01	1,13E+01	3,69E+01	MND	1,27E-02	0,00E+00	7,81E-02	2,79E-01	1,49E-02	-1,06E+01
Water use ⁵⁾	m ³ e depr.	6,92E-01	3,17E-03	5,57E+00	6,27E+00	MND	9,80E-04	0,00E+00	3,86E-04	9,48E-03	4,29E-05	-1,89E-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 FOR EN-5052 PRODUCT VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Particulate matter	Incidence	4,32E-07	2,24E-09	8,53E-08	5,20E-07	MND	7,31E-10	0,00E+00	5,39E-10	9,51E-09	2,94E-10	-2,90E-07
Ionizing radiation ⁶⁾	kBq U235e	1,56E+00	2,83E-04	4,72E-02	1,61E+00	MND	9,13E-05	0,00E+00	6,80E-05	9,67E-03	5,43E-05	-1,05E+00
Ecotoxicity (freshwater)	CTUe	1,71E+01	4,59E-02	2,88E+00	2,00E+01	MND	2,71E-02	0,00E+00	1,10E-02	9,71E-01	2,72E-02	-4,68E+00
Human toxicity, cancer	CTUh	1,12E-08	3,69E-12	5,75E-10	1,18E-08	MND	5,60E-12	0,00E+00	8,88E-13	6,80E-11	7,54E-13	-7,96E-09
Human tox. non-cancer	CTUh	7,51E-08	2,10E-10	1,77E-08	9,30E-08	MND	2,79E-10	0,00E+00	5,06E-11	4,04E-09	4,85E-11	-4,70E-08
SQP ⁷⁾	-	7,74E+00	3,27E-01	1,61E+02	1,69E+02	MND	2,42E-02	0,00E+00	7,87E-02	9,52E-01	9,99E-02	-3,52E+00

6) EN 15804+A2 disclaimer for Ionizing radiation, human health. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator; 7) SQP = Land use related impacts/soil quality.

ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2 FOR A2 1.4301 PRODUCT VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Particulate matter	Incidence	4,28E-07	8,57E-10	7,33E-08	5,02E-07	MND	2,35E-10	0,00E+00	5,39E-10	3,27E-09	9,78E-11	-3,58E-08
Ionizing radiation ⁶⁾	kBq U235e	3,18E-01	1,08E-04	2,67E-02	3,45E-01	MND	2,88E-05	0,00E+00	6,80E-05	2,27E-03	9,35E-06	4,49E-02
Ecotoxicity (freshwater)	CTUe	1,56E+01	1,76E-02	2,47E+00	1,80E+01	MND	8,99E-03	0,00E+00	1,10E-02	2,88E-01	1,25E-03	-1,29E+00
Human toxicity, cancer	CTUh	6,79E-09	1,41E-12	4,68E-10	7,25E-09	MND	1,91E-12	0,00E+00	8,88E-13	2,34E-11	1,12E-13	-8,45E-11
Human tox. non-cancer	CTUh	1,01E-07	8,04E-11	1,67E-08	1,18E-07	MND	9,91E-11	0,00E+00	5,06E-11	1,40E-09	2,57E-12	-2,37E-09
SQP ⁷⁾	-	2,58E+01	1,25E-01	1,50E+02	1,76E+02	MND	8,11E-03	0,00E+00	7,87E-02	5,20E-01	2,93E-02	-1,09E+00

6) EN 15804+A2 disclaimer for Ionizing radiation, human health. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator; 7) SQP = Land use related impacts/soil quality.

ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2 FOR S250GD PRODUCT VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Particulate matter	Incidence	2,72E-07	4,43E-09	9,18E-08	3,68E-07	MND	2,64E-10	0,00E+00	5,39E-10	3,27E-09	9,77E-11	-7,04E-08
Ionizing radiation ⁶⁾	kBq U235e	1,32E-01	5,59E-04	1,12E-01	2,45E-01	MND	3,30E-05	0,00E+00	6,80E-05	2,27E-03	9,34E-06	3,64E-02
Ecotoxicity (freshwater)	CTUe	1,83E+01	9,08E-02	5,69E+01	7,53E+01	MND	9,83E-03	0,00E+00	1,10E-02	2,95E-01	1,25E-03	-2,64E+00

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Human toxicity, cancer	CTUh	3,18E-09	7,30E-12	9,21E-10	4,11E-09	MND	2,04E-12	0,00E+00	8,88E-13	2,37E-11	1,12E-13	-1,77E-10
Human tox. non-cancer	CTUh	2,73E-08	4,16E-10	9,74E-08	1,25E-07	MND	1,02E-10	0,00E+00	5,06E-11	1,41E-09	2,56E-12	-8,49E-09
SQP ⁷⁾	-	6,59E+00	6,46E-01	1,52E+02	1,59E+02	MND	8,79E-03	0,00E+00	7,87E-02	5,19E-01	2,93E-02	-3,13E+00

6) EN 15804+A2 disclaimer for Ionizing radiation, human health. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator; 7) SQP = Land use related impacts/soil quality.

USE OF NATURAL RESOURCES FOR EN-5052 PRODUCT VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Renew. PER as energy ⁸⁾	MJ	3,42E+01	4,45E-03	5,23E+01	8,66E+01	MND	-2,37E+00	0,00E+00	1,07E-03	1,59E-01	8,56E-04	-2,47E+01
Renew. PER as material	MJ	0,00E+00	0,00E+00	1,87E+00	1,87E+00	MND	2,28E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renew. PER	MJ	3,42E+01	4,45E-03	5,42E+01	8,85E+01	MND	-2,15E+00	0,00E+00	1,07E-03	1,59E-01	8,56E-04	-2,47E+01
Non-re. PER as energy	MJ	9,44E+01	3,25E-01	6,49E+00	1,01E+02	MND	-1,11E-02	0,00E+00	7,81E-02	-1,89E+00	4,07E-02	-6,21E+01
Non-re. PER as material	MJ	3,79E+00	0,00E+00	1,65E-01	3,95E+00	MND	-1,65E-01	0,00E+00	0,00E+00	-3,79E+00	0,00E+00	0,00E+00
Total use of non-re. PER	MJ	9,82E+01	3,25E-01	6,66E+00	1,05E+02	MND	-1,28E-01	0,00E+00	7,81E-02	-5,68E+00	4,07E-02	-6,21E+01
Secondary materials	kg	2,29E-02	1,38E-04	1,51E-02	3,81E-02	MND	6,83E-05	0,00E+00	3,32E-05	7,46E-04	1,35E-05	5,59E-01
Renew. secondary fuels	MJ	1,53E-03	1,76E-06	4,96E-02	5,11E-02	MND	2,84E-07	0,00E+00	4,22E-07	2,46E-05	2,45E-07	-1,56E-04
Non-ren. secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m ³	2,44E+00	4,80E-05	1,25E-01	2,56E+00	MND	2,34E-05	0,00E+00	1,15E-05	8,70E-04	-4,92E-04	-1,66E-01

8) PER = Primary energy resources.

USE OF NATURAL RESOURCES FOR A2 1.4301 PRODUCT VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Renew. PER as energy ⁸⁾	MJ	1,33E+01	1,70E-03	5,12E+01	6,45E+01	MND	-8,40E-01	0,00E+00	1,07E-03	5,00E-02	1,44E-04	-4,70E-02
Renew. PER as material	MJ	0,00E+00	0,00E+00	6,55E-01	6,55E-01	MND	-3,48E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renew. PER	MJ	1,33E+01	1,70E-03	5,18E+01	6,52E+01	MND	-1,19E+00	0,00E+00	1,07E-03	5,00E-02	1,44E-04	-4,70E-02
Non-re. PER as energy	MJ	5,89E+01	1,24E-01	5,00E+00	6,40E+01	MND	-4,90E-03	0,00E+00	7,81E-02	-7,61E-01	1,49E-02	-5,02E+00
Non-re. PER as material	MJ	1,36E+00	0,00E+00	5,88E+00	1,41E+00	MND	-5,88E-02	0,00E+00	0,00E+00	-1,36E+00	0,00E+00	0,00E+00
Total use of non-re. PER	MJ	6,02E+01	1,24E-01	6,65E+00	6,70E+01	MND	-4,63E-02	0,00E+00	7,81E-02	-2,12E+00	1,49E-02	-5,02E+00
Secondary materials	kg	5,64E-01	5,29E-05	9,49E-03	5,73E-01	MND	2,31E-05	0,00E+00	3,32E-05	3,36E-04	3,74E-06	8,25E-01
Renew. secondary fuels	MJ	1,84E-03	6,72E-07	1,73E-02	1,92E-02	MND	9,36E-08	0,00E+00	4,22E-07	1,54E-05	7,74E-08	-2,12E-05
Non-ren. secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m ³	8,39E-01	1,84E-05	1,24E-01	9,63E-01	MND	8,71E-06	0,00E+00	1,15E-05	2,18E-04	1,55E-05	-6,34E-03

8) PER = Primary energy resources.

USE OF NATURAL RESOURCES FOR S250GD PRODUCT VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Renew. PER as energy ⁸⁾	MJ	2,80E+00	8,80E-03	5,19E+01	5,48E+01	MND	-8,68E-01	0,00E+00	1,07E-03	4,99E-02	1,43E-04	-8,23E-01
Renew. PER as material	MJ	0,00E+00	0,00E+00	6,86E-01	6,86E-01	MND	-3,78E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renew. PER	MJ	2,80E+00	8,80E-03	5,26E+01	5,54E+01	MND	-1,25E+00	0,00E+00	1,07E-03	4,99E-02	1,43E-04	-8,23E-01
Non-re. PER as energy	MJ	2,35E+01	6,42E-01	9,63E+00	3,38E+01	MND	-4,01E-03	0,00E+00	7,81E-02	-8,16E-01	1,49E-02	-1,06E+01
Non-re. PER as material	MJ	1,44E+00	0,00E+00	6,05E-02	1,50E+00	MND	-6,05E-02	0,00E+00	0,00E+00	-1,44E+00	0,00E+00	0,00E+00
Total use of non-re. PER	MJ	2,50E+01	6,42E-01	1,13E+01	3,69E+01	MND	-4,71E-02	0,00E+00	7,81E-02	-2,24E+00	4,17E-03	-1,06E+01
Secondary materials	kg	4,28E-01	2,73E-04	1,30E-02	4,41E-01	MND	2,48E-05	0,00E+00	3,32E-05	3,36E-04	3,74E-06	6,28E-01
Renew. secondary fuels	MJ	6,97E-04	3,47E-06	1,84E-02	1,91E-02	MND	1,03E-07	0,00E+00	4,22E-07	1,54E-05	7,73E-08	-8,76E-05
Non-ren. secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m ³	8,48E-01	9,49E-05	-1,08E+00	-2,31E-01	MND	8,61E-06	0,00E+00	1,15E-05	2,21E-04	1,55E-05	-2,66E-03

8) PER = Primary energy resources.

END OF LIFE – WASTE FOR EN-5052 PRODUCT VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	kg	1,44E+00	5,50E-04	3,61E-02	1,48E+00	MND	6,84E-04	0,00E+00	1,32E-04	1,85E-02	6,87E-05	-1,00E+00
Non-hazardous waste	kg	1,48E+01	1,02E-02	9,56E-01	1,58E+01	MND	7,48E-02	0,00E+00	2,45E-03	5,00E-01	6,25E-01	-9,75E+00
Radioactive waste	kg	4,11E-04	6,92E-08	1,20E-05	4,23E-04	MND	2,23E-08	0,00E+00	1,67E-08	2,47E-06	1,33E-08	-2,80E-04

END OF LIFE – WASTE FOR A2 1.4301 PRODUCT VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	kg	4,97E+00	2,10E-04	3,01E-02	5,00E+00	MND	2,58E-04	0,00E+00	1,32E-04	2,91E-03	1,64E-05	-8,27E-02
Non-hazardous waste	kg	1,07E+01	3,90E-03	7,29E-01	1,14E+01	MND	3,06E-02	0,00E+00	2,45E-03	9,43E-02	3,76E-04	-4,66E-01
Radioactive waste	kg	7,90E-05	2,65E-08	6,77E-06	8,58E-05	MND	7,06E-09	0,00E+00	1,67E-08	5,82E-07	2,28E-09	1,21E-05

END OF LIFE – WASTE FOR S250GD PRODUCT VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	kg	8,11E-01	1,09E-03	5,44E-02	8,66E-01	MND	2,52E-04	0,00E+00	1,32E-04	2,96E-03	1,64E-05	-3,51E-01
Non-hazardous waste	kg	4,99E+00	2,01E-02	1,21E+03	1,22E+03	MND	2,78E-02	0,00E+00	2,45E-03	9,58E-02	3,75E-04	-2,79E+00
Radioactive waste	kg	3,33E-05	1,37E-07	2,88E-05	6,22E-05	MND	8,08E-09	0,00E+00	1,67E-08	5,81E-07	2,28E-09	9,49E-06

END OF LIFE – OUTPUT FLOWS FOR EN-5052 PRODUCT VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	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	7,84E-03	7,84E-03	MND	7,80E-02	0,00E+00	0,00E+00	7,45E-01	0,00E+00	0,00E+00
Materials for energy rec	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	6,82E-02	0,00E+00	0,00E+00	7,99E-02	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	2,23E+00	0,00E+00	0,00E+00
Exported energy – Electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	5,16E-01	0,00E+00	0,00E+00
Exported energy – Heat	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	1,72E+00	0,00E+00	0,00E+00

END OF LIFE – OUTPUT FLOWS FOR A2 1.4301 PRODUCT VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	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	6,54E-03	6,54E-03	MND	2,30E-02	0,00E+00	0,00E+00	8,74E-01	0,00E+00	0,00E+00
Materials for energy rec	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	2,84E-02	0,00E+00	0,00E+00	2,86E-02	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	7,99E-01	0,00E+00	0,00E+00
Exported energy – Electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	1,84E-01	0,00E+00	0,00E+00
Exported energy – Heat	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	6,15E-01	0,00E+00	0,00E+00

END OF LIFE – OUTPUT FLOWS FOR S250GD PRODUCT VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	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	8,80E-03	8,80E-03	MND	2,80E-02	0,00E+00	0,00E+00	8,73E-01	0,00E+00	0,00E+00
Materials for energy rec	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	4,26E-04	0,00E+00	0,00E+00	3,01E-02	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	8,41E-01	0,00E+00	0,00E+00
Exported energy – Electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	1,94E-01	0,00E+00	0,00E+00
Exported energy – Heat	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	6,47E-01	0,00E+00	0,00E+00

KEY INFORMATION TABLE (RTS) – KEY INFORMATION PER KG OF PRODUCT A2 EN-5052 VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP – total	kg CO ₂ e	6,19E+00	2,24E-02	4,61E-01	6,68E+00	MND	2,27E-01	0,00E+00	5,38E-03	3,44E-01	1,75E-03	-4,04E+00
ADP-minerals & metals	kg Sbe	1,51E-05	6,24E-08	7,51E-06	2,27E-05	MND	2,22E-08	0,00E+00	1,50E-08	3,99E-06	3,43E-09	4,13E-06
ADP-fossil resources	MJ	9,83E+01	3,25E-01	8,24E+00	1,07E+02	MND	3,47E-02	0,00E+00	7,81E-02	1,01E+00	4,07E-02	-6,21E+01

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Water use	m ³ e depr.	1,05E+01	1,60E-03	5,43E+00	1,59E+01	MND	2,64E-03	0,00E+00	3,86E-04	3,50E-02	2,46E-04	-7,67E+00
Secondary materials	kg	2,29E-02	1,38E-04	1,51E-02	3,81E-02	MND	6,83E-05	0,00E+00	3,32E-05	7,46E-04	1,35E-05	5,59E-01
Biog. C in product ⁹⁾	kg C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Biog. C in packaging	kg C	N/A	N/A	2,01E-02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

9) Biog. C in product = biogenic carbon content in product.

KEY INFORMATION TABLE (RTS) – KEY INFORMATION PER KG OF PRODUCT A2 1.4301 VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP – total	kg CO ₂ e	5,29E+00	8,57E-03	5,08E-01	5,80E+00	MND	7,95E-02	0,00E+00	5,39E-03	8,78E-02	6,07E-04	-5,27E-01
ADP-minerals & metals	kg Sbe	1,23E-04	2,39E-08	7,11E-06	1,30E-04	MND	6,95E-09	0,00E+00	1,50E-08	1,41E-06	9,63E-10	-4,16E-07
ADP-fossil resources	MJ	6,03E+01	1,24E-01	6,65E+00	6,70E+01	MND	1,21E-02	0,00E+00	7,81E-02	2,78E-01	1,49E-02	-5,02E+00
Water use	m ³ e depr.	1,62E+00	6,14E-04	5,37E+00	7,00E+00	MND	1,06E-03	0,00E+00	3,86E-04	9,25E-03	4,29E-05	-2,95E-01
Secondary materials	kg	5,64E-01	5,29E-05	9,49E-03	5,73E-01	MND	2,31E-05	0,00E+00	3,32E-05	3,36E-04	3,74E-06	8,25E-01
Biog. C in product ⁹⁾	kg C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Biog. C in packaging	kg C	N/A	N/A	2,01E-02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

9) Biog. C in product = biogenic carbon content in product.

KEY INFORMATION TABLE (RTS) – KEY INFORMATION PER KG OF PRODUCT S250GD VARIATION

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP – total	kg CO ₂ e	2,04E+00	4,43E-02	7,63E-01	2,85E+00	MND	8,30E-02	0,00E+00	5,39E-03	9,13E-02	6,06E-04	-1,12E+00
ADP-minerals & metals	kg Sbe	5,54E-05	1,23E-07	9,10E-06	6,47E-05	MND	8,02E-09	0,00E+00	1,50E-08	1,40E-06	9,62E-10	-1,03E-05
ADP-fossil resources	MJ	2,50E+01	6,42E-01	1,13E+01	3,69E+01	MND	1,27E-02	0,00E+00	7,81E-02	2,79E-01	1,49E-02	-1,06E+01
Water use	m ³ e depr.	6,92E-01	3,17E-03	5,57E+00	6,27E+00	MND	9,80E-04	0,00E+00	3,86E-04	9,48E-03	4,29E-05	-1,89E-01
Secondary materials	kg	4,28E-01	2,73E-04	1,30E-02	4,41E-01	MND	2,48E-05	0,00E+00	3,32E-05	3,36E-04	3,74E-06	6,28E-01

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Biog. C in product ⁹⁾	kg C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Biog. C in packaging	kg C	N/A	N/A	2,01E-02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

9) Biog. C in product = biogenic carbon content in product.

SCENARIO DOCUMENTATION

Manufacturing energy scenario documentation for all material variations

Scenario parameter	Value
Electricity data source and quality	Electricity production, hydro, reservoir, non-alpine region, World, Ecoinvent 3.10.1 & Electricity production, wind, >3MW turbine, onshore, Austria, Ecoinvent 3.10.1 & Electricity production, photovoltaic, 570kWp open ground installation, multi-Si, World, Ecoinvent 3.10.1 & eat and power co-generation, biogas, gas engine, Portugal, Ecoinvent 3.10.1 & Electricity production, wood, future, World, Ecoinvent 3.10.1 & Electricity production, photovoltaic, 3kWp slanted-roof installation, multi-Si, panel, mounted, Austria, Ecoinvent 3.10.1
Electricity kg CO ₂ e / kWh (combined)	0,3799
District heating data source and quality	Natural gas, burned in micro gas turbine, 100kWe, Switzerland, Ecoinvent 3.10.1
District heating kg CO ₂ e / kWh	0,0355

End of life scenario documentation for EN-5052 Product variation

Scenario information	Value
Collection process – kg collected separately	1
Collection process – kg collected with mixed waste	0
Recovery process – kg for re-use	0
Recovery process – kg for recycling	0,745
Recovery process – kg for energy recovery	0,08
Disposal (total) – kg for final deposition	0,175
Scenario assumptions e.g. transportation	Transport to treatment or landfill is assumed to be 50km

End of life scenario documentation for A2 1.4301 Product variation

Scenario information	Value
Collection process – kg collected separately	1
Collection process – kg collected with mixed waste	0
Recovery process – kg for re-use	0
Recovery process – kg for recycling	0,87
Recovery process – kg for energy recovery	0,03
Disposal (total) – kg for final deposition	0,10
Scenario assumptions e.g. transportation	Transport to treatment or landfill is assumed to be 50km

End of life scenario documentation for S250GD Product variation

Scenario information	Value
Collection process – kg collected separately	1
Collection process – kg collected with mixed waste	0
Recovery process – kg for re-use	0
Recovery process – kg for recycling	0,87
Recovery process – kg for energy recovery	0,03
Disposal (total) – kg for final deposition	0,10
Scenario assumptions e.g. transportation	Transport to treatment or landfill is assumed to be 50km