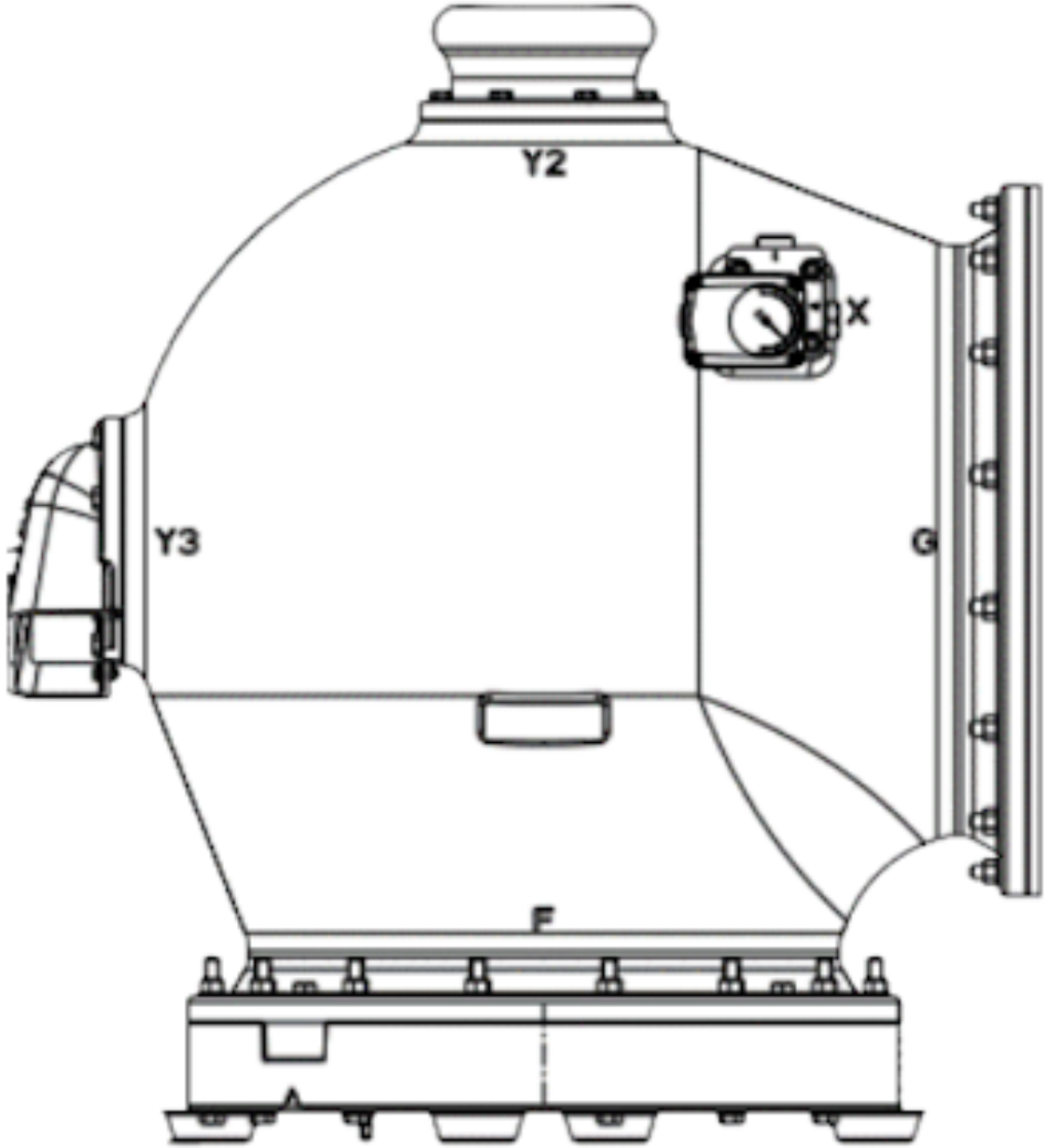
Environmental Product Declaration (EPD)
According to ISO 14025 and EN 15804+A2:2019

Elbow T155-7g



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Valid until:	28-05-2030
Declaration owner:	Grid Solutions
Publisher:	Kiwa-Ecobility Experts
Programme operator:	Kiwa-Ecobility Experts
Status:	verified

1 General information

1.1 PRODUCT

Elbow T155-7g

1.2 REGISTRATION NUMBER

EPD-Kiwa-EE-202605-EN

1.3 VALIDITY

Issue date: 28-05-2025

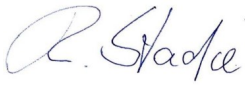
Valid until: 28-05-2030

1.4 PROGRAMME OPERATOR

Kiwa-Ecobility Experts
Wattstraße 11-13
13355 Berlin
DE

Raoul Mancke

(Head of programme operations, Kiwa-Ecobility Experts)



Dr. Ronny Stadie

(Verification body, Kiwa-Ecobility Experts)

1.5 OWNER OF THE DECLARATION

Manufacturer: Grid Solutions

Address: 167 QUAI de la bataille de stalingrad , 92130 Issy-les-Moulineaux, France

E-mail: Solene.Michaud@gevernova.com

Website: www.gevernova.com/grid-solutions

Production location: Grid Solutions

Address production location: 1 rue Paul Doumer , 73 106 Aix-les-Bains, France

1.6 VERIFICATION OF THE DECLARATION

The independent verification is in accordance with the ISO 14025:2011. The LCA is in compliance with ISO 14040:2006 and ISO 14044:2006. The EN 15804+A2:2019 serves as the core PCR.

☐ Internal ☒ External

Elisabeth Amat Guasch, Greenize

1.7 STATEMENTS

The owner of this EPD shall be liable for the underlying information and evidence. The programme operator Kiwa-Ecobility Experts shall not be liable with respect to manufacturer data, life cycle assessment data and evidence.

1.8 PRODUCT CATEGORY RULES

Kiwa-Ecobility Experts (Kiwa-EE) – General Programme Instructions “Product Level" SOP EE 1203_R. 2.0

Kiwa-Ecobility Experts, General Programme Instructions “Product Level” – Annex B1 Environmental Information Programme according to EN 15804 / ISO 21930, SOP EE 1203_R. 2.0

EPDItaly007 Core Product Category Rules based on EN 50693 for electrical and electronic products Rev. 3.1 (2024-11-12)

1 General information

1.9 COMPARABILITY

In principle, a comparison or assessment of the environmental impacts of different products is only possible if they have been prepared in accordance with EN 15804+A2:2019. For the evaluation of the comparability, the following aspects have to be considered in particular: PCR used, functional or declared unit, geographical reference, the definition of the system boundary, declared modules, data selection (primary or secondary data, background database, data quality), scenarios used for use and disposal phases, and the life cycle inventory (data collection, calculation methods, allocations, validity period). PCRs and general program instructions of different EPD program operators may differ. Comparability needs to be evaluated. For further guidance, see EN 15804+A2:2019 and ISO 14025.

1.10 CALCULATION BASIS

LCA method R<THINK: Ecobility Experts | EN15804+A2

LCA software*: Simapro 9.6

Characterization method: R<THINK characterization method (see references for more details)

LCA database profiles: ecoinvent (for version see references)

Version database: v3.19 (20250306)

** Simapro is used for calculating the characterized results of the Environmental profiles within R<THINK.*

1.11 LCA BACKGROUND REPORT

This EPD is generated on the basis of the LCA background report 'Elbow T155-7g' with the calculation identifier ReTHiNK-102605.

2 Product

2.1 PRODUCT DESCRIPTION

The product is a compartment allowing to create 90° angles between two sections of straight Gas Insulated Lines (GIL). This compartment is made of an enclosure filled with pressurized insulated gas(g3) and an electrode maintained by a spacer. This electrode allows to connect primary conductors of the two adjacent Gas Insulated Lines. For temperature down to -25°C.

To carry a rated continuous current of 5000A under normal circuit condition and withstand a rated voltage of 420kV and change its direction from 90°.

This EPD is representative for the product GE Vernova's Elbow T155-7g.

The constituent materials of Elbow T155-7g are given in the table below:

Materials	Mass (kg)	%
Stainless Steel	10.981	8.99
Aluminium and its alloys	93.734	76.71
Copper and its alloys	0.470	0.38
PolyPropylene (PP)	0.526	0.43
PolyAmide (PA)	0.486	0.40
Epoxy resin (EP)	14.206	11.63
Ethylene Propylene Diene Monomer (EPDM)	0.003	0.00
Other elastomers	0.280	0.23
Refrigerants and cryogens	1.500	1.23
Total (kg)	**122.186**	**100**

The materials used for packaging are presented below:

Packaging material	Mass (kg)
Plywood	14.774
PolyEthylene (PE)	0.040
Polypropylene (PP)	0.018
Polyurethane (PU - Proxy for foam)	0.006
Polyvinyl chloride (PVC - Proxy for tape)	0.003
Sawnwood	8.827
Steel (screw)	0.008
Total	**23.68**

2.2 APPLICATION (INTENDED USE OF THE PRODUCT)

The Elbow T155-7g from GE Vernova can be used in power transmission and distribution, including integration of renewable energy, offshore/onshore wind connections, large power plants, industry applications, and long-range power transmission.

2.3 REFERENCE SERVICE LIFE

RSL PRODUCT

According to the manufacturer, the service life is 40 years, based on IEC 62271-320. However, this Reference Service Life (RSL) of 40 years is a theoretical value used solely for calculation purposes.

USED RSL (YR) IN THIS LCA CALCULATION:

40

RSL PARTS

-

Description	Material	RSL [yr]
Maintenance (B2)		
g3 leakage during use	g3	1

2.4 TECHNICAL DATA

Electrical characteristics of ElbowT168 are given in Table below.

Characteristics	Units	Value
Rated Voltage	kVms	420
Rated nominal current	Ams	5000
Rated frequency	Hz	50/60

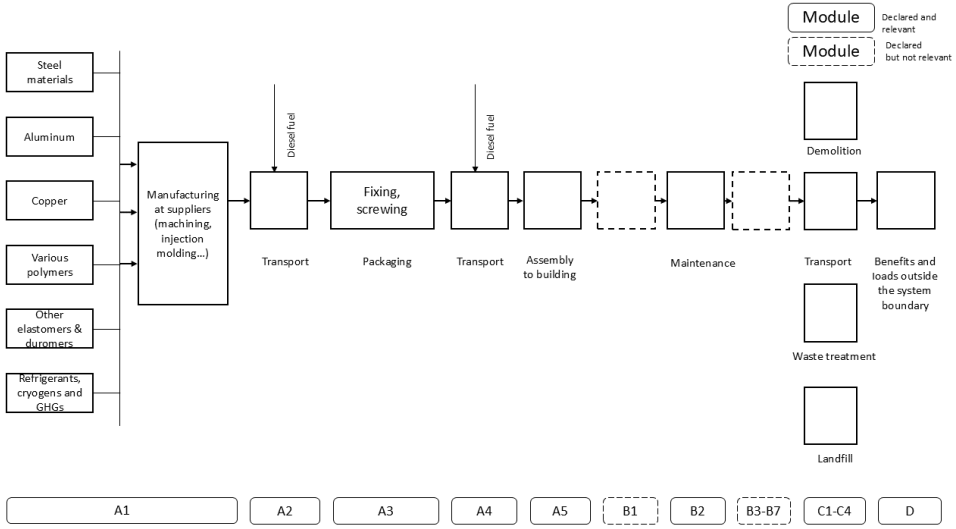
2 Product

2.5 SUBSTANCES OF VERY HIGH CONCERN

According to the manufacturer, no substance present in the product with a concentration exceeding 0.1% of the total weight is included on the "List of Substances of Very High Concern" (SVHC) for authorization under REACH legislation.

2.6 DESCRIPTION PRODUCTION PROCESS

The product is manufactured using a variety of raw materials, including stainless steel, aluminum, copper, various plastics and elastomers. Component production takes place at external suppliers through processes such as machining and injection molding. These components are then transported by truck to the assembly facility located in France. At the French factory, the final product is assembled through mechanical operations such as fixing and screwing. The assembled units are packaged using wooden boxes and plastic protective materials before being prepared for delivery to the installation site.



2.7 CONSTRUCTION DESCRIPTION

Construction is declared to account for the environmental impacts associated with the end-of-life packaging.

3 Calculation rules

3.1 FUNCTIONAL UNIT

1 piece

1 piece of Elbow T155-7g

Reference unit: piece (p)

3.2 CONVERSION FACTORS

Description	Value	Unit
Reference unit	1	p
Weight per reference unit	122.186	kg
Conversion factor to 1 kg	0.008184	p

3.3 SCOPE OF DECLARATION AND SYSTEM BOUNDARIES

This is a Cradle to grave EPD. The life cycle stages included are as shown below:

(X = module included, ND = module not declared)

A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

The modules of the EN 15804 contain the following:

Module A1 = Raw material supply	Module B5 = Refurbishment
Module A2 = Transport	Module B6 = Operational energy use
Module A3 = Manufacturing	Module B7 = Operational water use
Module A4 = Transport	Module C1 = De-construction / Demolition
Module A5 = Construction - Installation process	Module C2 = Transport
Module B1 = Use	Module C3 = Waste Processing
Module B2 = Maintenance	Module C4 = Disposal
Module B3 = Repair	Module D = Benefits and loads beyond the product system boundaries
Module B4 = Replacement	

3.4 REPRESENTATIVENESS

This EPD is representative for Elbow T155-7g, a product of Grid Solutions . The results of this EPD are representative for European Union.

3.5 CUT-OFF CRITERIA

Product stage (A1-A3)

All input flows (e.g. raw materials, transportation, energy use, packaging, etc.) and output flows (e.g. production waste) are considered in this LCA. The total neglected input flows do therefore not exceed the limit of 5% of energy use and mass.

3 Calculation rules

Construction process stage (A4-A5)

All input flows (e.g. transportation to the construction site, additional raw material use for construction, installation energy (use)of energy use for assembly , etc.) and output flows (e.g. construction waste, packaging waste, etc.) are considered in this LCA. The total neglected input flows do therefore not exceed the limit of 5% of energy use and mass.

Use stage (B2)

The product is a passive component that does not require energy, water, or replacement during its service life. Therefore, Modules B1, B3, B4, B5, B6, and B7 are considered as not relevant. Module B2 (maintenance) is included to account for potential gas leakage during the use phase.

All (known) input flows (e.g. raw materials, transportation, energy use, packaging, etc.) and output flows (e.g. emissions to soil, air and water, construction waste, packaging waste, end-of-life waste, etc.) related to the building fabric are considered in this LCA. The total neglected input flows do therefore not exceed the limit of 5% of energy use and mass.

End of life stage (C1-C4)

All input flows (e.g. energy use for demolition or disassembly, transport to waste processing, etc.) and output flows (e.g. end-of-life waste processing of the product, etc.) are considered in this LCA. The total neglected input flows do therefore not exceed the limit of 5% of energy use and mass.

For demolition, the energy consumption associated with deconstruction or dismantling is calculated in accordance with the Product Environmental Footprint Category Rules (PEFCRs) for Building Products (2019).

Assumption for the demolition at EoL	Amount per kg of demolished material	Unit	Data set	Database
Diesel consumption in construction machine	0.0437	MJ/ kg	Thermal energy from light fuel oil	Sphera

Benefits and loads beyond the system boundary (Module D)

All benefits and loads beyond the system boundary resulting from reusable products, recyclable materials and/or useful energy carriers leaving the product system are considered in this LCA.

Excluded Elements from LCA Calculation

- The transport of personnel to the plant;
- The transportation of personnel within the plant
- Research and development activities;
- Long-term emissions.

3.6 ALLOCATION

Allocations were avoided as far as possible. No by-products or co-products are produced during the manufacture of the analysed product. The energy requirements of production were allocated to the individual products on the basis of energy consumption measurements. Specific information on the allocations within the background data can be found in the documentation of the Ecoinvent datasets.

The transport of parts and materials to the assembly site was modeled based on the geographical repartition of suppliers and corresponding transport hypotheses.

3.7 DATA COLLECTION & REFERENCE PERIOD

All primary data were collected by manufacture of product for the reference year of 2023 covering the period from January to December 2023.

3.8 ESTIMATES AND ASSUMPTIONS

- Due to the large number of suppliers and associated data limitations, transport has been modeled using generic profiles representative of typical supply chains where specific data was not available. A company-specific transport profile has been applied to reflect realistic sourcing practices. The following assumptions apply:

1. Domestic sourcing (within France): Transported 1,000 km by freight lorry, 16–32 metric tons, EURO 6, diesel.
2. European sourcing (EU): Transported 3,500 km by freight lorry, 16–32 metric tons, EURO 6, diesel.

3 Calculation rules

3. Global sourcing: Shipped 19,000 km by sea freight (oceanic container ship, heavy fuel oil) and transported a further 1,000 km by freight lorry, 16–32 metric tons, EURO 4, diesel.

- The G3 insulation gas consists of a C4F7N / O2 / CO2 mixture. This gas has been modelled separately based on the manufacturer's data and in accordance with the Grid Solutions harmonized standard document NT312440.
- C_4F_7N production has been modeled using assumptions and secondary data, including proxy datasets from Ecoinvent. Results may differ from actual industrial production.
- A payload factor of 50 percent was used for all truck transports, which in fact corresponds to a full delivery and empty return trip. A data set for a non-specific truck was used.
- During the demolition phase, a 0.09% leakage rate of g3 gas is assumed. This amount has been calculated and considered in the emissions calculation.
- For the end-of-life scenario, the End of life default scenarios suggested in IEC/TR 62635 (Annex D.3) are used.
- Module A4 (Transport) is calculated based on the assumption that the product is transported over a distance of 2,650 km from the factory in Aix-les-Bains, France, to Bergen, Norway. The transportation is assumed to involve a combination of road and sea freight, using the following datasets:

1. Transport, freight, lorry, unspecified {RER} | market for transport, freight, lorry, unspecified | Cut-off, U
2. Transport, freight, sea, container ship {GLO} | market for transport, freight, sea, container ship | Cut-off, U

- The product is a passive component that does not require energy, water, or replacement during its service life. Therefore, Modules B1, B3, B4, B5, B6, and B7 are considered as not relevant. Module B2 (maintenance) is included to account for potential gas leakage during the use phase.
- Gas leakage during the use phase (B2 – Maintenance) has been calculated in the model and represents 0.5% of the total gas mass.
- The A5 (Installation) is declared to account for the environmental impacts associated with the end-of-life of packaging.

3.9 DATA QUALITY

Both primary and secondary data have been used. All primary data were collected by the product manufacturer for the reference year 2023, covering the period from January to December. The main source of primary data is the bill of materials, supplemented by factory-specific data provided by the manufacturing facility in France.

For the data, which was needed for modelling but was not provided by the manufacturer and could not be influenced by them, generic data was used. Secondary data were sourced from the regularly updated Ecoinvent database (version 3.9.1), aligning with EN 15804 standards to ensure background data not exceeding 10 years.

ReTHINK EPD web application was used to model the life cycle for the production and disposal of the declared product systems. To ensure that the results are comparable, consistent background data from the international database Ecoinvent was used in the LCA (e.g. data records on energy, transport, auxiliary materials, and suppliers). Almost all consistent data sets contained in the Ecoinvent database are documented and can be viewed online.

The scenarios included are currently in use and are representative for one of the most likely scenario alternatives. According to the criteria of the “UN Environmental Global Guidance on LCA database development” mentioned in EN 15804+A2, the data quality for all three representativeness categories (geographical, technical and time) can be described as good.

3.10 POWER MIX

With regard to the energy consumption, a "market-based approach" was used. Electricity supply is based on the French national residual grid mix , using the dataset "Electricity, medium voltage {FR} | electricity, medium voltage, residual mix. This mix has a total Global Warming Potential (GWP) of 0.0813 kg CO_2 eq. per kWh..

4 Scenarios and additional technical information

4.1 TRANSPORT TO CONSTRUCTION SITE (A4)

For the transport from production place to assembly/user, the following scenario is assumed for module A4 of this EPD.

	Value and unit
Vehicle type used for transport	Transport for installation (lorry & Sea)
Fuel type and consumption of vehicle	not available
Distance	2650 km
Capacity utilisation (including empty returns)	50 % (loaded up and return empty)
Bulk density of transported products	inapplicable
Volume capacity utilisation factor	1

4.2 ASSEMBLY (A5)

The following information describes the scenarios for flows entering the system and flows leaving the system at module A5.

FLOWS ENTERING THE SYSTEM

For flows entering the system at A5 the following scenario is assumed for module A5.

	Value	Unit
Energy consumption for installation/assembly		
(ei3.9.1) Diesel, burned in machine (incl. emissions)	0.1344	l

FLOWS LEAVING THE SYSTEM

The following output flows leaving the system at module A5 are assumed.

Description	Value	Unit
Output materials as result of loss during construction	3	%
Output materials as result of waste processing of materials used for installation/assembly at the building site	0.000	kg
Output materials as result of waste processing of used packaging	23.676	kg

4.3 USE STAGE (B1)

No significant environment impact in the use stage modules, because there is no (significant) emission to air, soil or water.

4 Scenarios and additional technical information

4.4 MAINTENANCE (B2)

Technical maintenance is needed during Use Stage. For maintenance the scenario(s) as mentioned below are included in this EPD.

Description	Service cycle (yr)	Number of cycles (n)	Amount per cycle	Total Amount	Unit
g3 leakage during use	1	39	0.0075	0.2925	kg

4.5 REPAIR (B3)

Repairs are not applicable within the functional unit and to achieve the reference service life.

4.6 OPERATIONAL ENERGY USE (B6)

Description	Service cycle (yr)	Number of cycles (n)	Amount per cycle	Total Amount	Unit

4.7 OPERATIONAL WATER USE (B7)

Description	Service cycle (yr)	Number of cycles (n)	Amount per cycle	Total Amount	Unit

4.8 DE-CONSTRUCTION, DEMOLITION (C1)

The following information describes the scenario for demolition at end of life.

Description	Amount	Unit
(ei3.9.1) Diesel, burned in machine (incl. emissions)	0.134	l
g3	0.001	kg

4.9 TRANSPORT END-OF-LIFE (C2)

The following distances and transport conveyance are assumed for transportation during end of life for the different types of waste processing.

4 Scenarios and additional technical information

Waste Scenario	Transport conveyance	Not removed (stays in work) [km]	Landfill [km]	Incineration [km]	Recycling [km]	Re-use [km]
Steel waste scenario	(ei3.9.1) Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	0
Aluminium waste scenario	(ei3.9.1) Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	0
Copper waste scenario	(ei3.9.1) Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	0
PVC	(ei3.9.1) Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	0
PET waste scenario	(ei3.9.1) Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	0
EPDM	(ei3.9.1) Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	0
Other duromers	(ei3.9.1) Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	0
Epoxy resin	(ei3.9.1) Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	0
Gas g3 waste scenario	(ei3.9.1) Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	0

The transport conveyance(s) used in the scenario(s) for transport during end of life has the following characteristics.

	Value and unit
Vehicle type used for transport	(ei3.9.1) Lorry (Truck), unspecified (default) | market group for (GLO)
Fuel type and consumption of vehicle	not available
Capacity utilisation (including empty returns)	50 % (loaded up and return empty)
Bulk density of transported products	inapplicable
Volume capacity utilisation factor	1

4 Scenarios and additional technical information

4.10 END OF LIFE (C3, C4)

The scenario(s) assumed for end of life of the product are given in the following tables.
First the assumed percentages per type of waste processing are displayed, followed by the assumed amounts.

Waste Scenario	Region	Not removed (stays in work) [%]	Landfill [%]	Incineration [%]	Recycling [%]	Re-use [%]
Steel waste scenario	EU	0	6	0	94	0
Aluminium waste scenario	EU	0	9	3	91	0
Copper waste scenario	EU	0	15	0	85	0
PVC	EU	0	95	5	0	0
PET waste scenario	EU	0	95	5	0	0
EPDM	EU	0	30	70	0	0
Other duromers	EU	0	30	70	0	0
Epoxy resin	EU	0	95	5	0	0
Gas g3 waste scenario	EU	1	0	39	60	0

Waste Scenario	Not removed (stays in work) [kg]	Landfill [kg]	Incineration [kg]	Recycling [kg]	Re-use [kg]
Steel waste scenario	0.000	0.659	0.000	10.322	0.000
Aluminium waste scenario	0.000	8.436	2.812	85.298	0.000
Copper waste scenario	0.000	0.070	0.000	0.400	0.000
PVC	0.000	0.500	0.026	0.000	0.000
PET waste scenario	0.000	0.462	0.024	0.000	0.000
EPDM	0.000	0.001	0.002	0.000	0.000
Other duromers	0.000	0.084	0.196	0.000	0.000
Epoxy resin	0.000	13.496	0.710	0.000	0.000
Gas g3 waste scenario	0.015	0.000	0.585	0.900	0.000
Total	**0.015**	**23.707**	**4.356**	**96.920**	**0.000**

4 Scenarios and additional technical information

4.11 BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY (D)

The presented Benefits and loads beyond the system boundary in this EPD are based on the following calculated Net output flows in kilograms and Energy recovery displayed in MJ Lower Heating Value.

Waste Scenario	Net output flow [kg]	Energy recovery [MJ]
Steel waste scenario	5.298	0.000
Aluminium waste scenario	16.066	0.000
Copper waste scenario	0.400	0.000
PVC	0.000	0.566
PET waste scenario	0.000	0.748
EPDM	0.000	0.056
Other duromers	0.000	5.235
Epoxy resin	0.000	21.870
Gas g3 waste scenario	0.900	0.000
Total	**22.664**	**28.475**

5 Results

For the impact assessment long-term emissions (>100 years) are not considered. The results of the impact assessment are only relative statements that do not make any statements about end-points of the impact categories, exceedance of threshold values, safety margins or risks. The following tables show the results of the indicators of the impact assessment, of the use of resources as well as of waste and other output flows.

5.1 ENVIRONMENTAL IMPACT INDICATORS PER PIECE

CORE ENVIRONMENTAL IMPACT INDICATORS EN 15804+A2

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq.	1.13E+3	2.74E+1	4.65E+1	1.21E+3	5.44E+1	7.68E+1	0.00E+0	1.62E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.50E-1	1.17E+0	2.98E+1	1.95E+0	-2.70E+2
GWP-f	kg CO_2 eq.	1.12E+3	2.74E+1	7.67E+1	1.23E+3	5.44E+1	4.10E+1	0.00E+0	1.62E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.50E-1	1.17E+0	2.97E+1	1.94E+0	-2.69E+2
GWP-b	kg CO_2 eq.	7.22E+0	8.82E-3	-3.03E+1	-2.31E+1	1.80E-2	3.58E+1	0.00E+0	4.06E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.42E-5	3.81E-4	9.70E-2	1.77E-3	1.51E-1
GWP-luluc	kg CO_2 eq.	2.46E+0	1.35E-2	1.24E-1	2.60E+0	2.66E-2	8.24E-2	0.00E+0	1.84E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.14E-5	4.16E-3	2.37E-2	4.91E-4	-8.51E-1
ODP	kg CFC 11 eq.	2.25E-5	6.07E-7	8.71E-6	3.18E-5	1.19E-6	1.97E-6	0.00E+0	6.97E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.81E-9	2.08E-8	4.13E-7	8.06E-9	-7.79E-4
AP	mol H+ eq.	6.68E+0	6.02E-2	2.91E-1	7.04E+0	2.60E-1	2.36E-1	0.00E+0	9.00E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.46E-3	5.59E-3	1.07E-1	3.43E-3	-2.18E+0
EP-fw	kg P eq.	3.98E-2	2.23E-4	2.50E-3	4.25E-2	4.46E-4	1.33E-3	0.00E+0	7.73E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.04E-6	1.16E-5	5.54E-4	1.35E-5	-8.35E-3
EP-m	kg N eq.	1.05E+0	1.48E-2	7.85E-2	1.14E+0	1.01E-1	4.38E-2	0.00E+0	1.41E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.05E-3	2.13E-3	1.90E-2	1.64E-3	-2.84E-1
EP-T	mol N eq.	1.15E+1	1.55E-1	8.74E-1	1.26E+1	1.09E+0	4.76E-1	0.00E+0	1.57E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.24E-2	2.27E-2	2.16E-1	1.10E-2	-3.19E+0
POCP		3.78E+0	9.31E-2	3.09E-1	4.18E+0	3.80E-1	1.57E-1	0.00E+0	6.23E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.63E-3	7.74E-3	7.13E-2	4.08E-3	-1.01E+0

GWP-total=Global Warming Potential total (GWP-total) | **GWP-f**=Global Warming Potential fossil fuels (GWP-fossil) | **GWP-b**=Global Warming Potential biogenic (GWP-biogenic) | **GWP-luluc**=Global Warming Potential land use and land use change (GWP-luluc) | **ODP**=Depletion potential of the stratosperic ozon layer (ODP) | **AP**=Acidification potential, Accumulated Exceedance (AP) | **EP-fw**=Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater) | **EP-m**=Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine) | **EP-T**=Eutrophication potential, Accumulated Exceedance (EP-terrestrial) | **POCP**=Formation potential of tropospheric ozone (POCP) | **ADP-mm**=Abiotic depletion potential for non fossil resources (ADP mm) | **ADP-f**=Abiotic depletion for fossil resources potential (ADP fossil) | **WDP**=Water (user) deprication potential, deprivation-weighted water consumption (WDP)

5 Results

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	kg NMVOC eq.																		
ADP-mm	kg Sb-eq.	1.46E-2	8.95E-5	8.08E-4	1.55E-2	1.69E-4	4.85E-4	0.00E+0	1.79E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.45E-7	3.66E-6	5.72E-4	1.05E-6	3.21E-3
ADP-f	MJ	1.21E+4	3.89E+2	2.65E+3	1.51E+4	7.85E+2	5.05E+2	0.00E+0	3.77E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.41E+0	1.67E+1	1.97E+2	8.64E+0	-2.43E+3
WDP	m3 world eq.	2.40E+2	1.60E+0	3.88E+1	2.80E+2	3.41E+0	8.78E+0	0.00E+0	7.86E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.69E-2	9.14E-2	2.23E+0	2.80E-1	2.89E+1

GWP-total=Global Warming Potential total (GWP-total) | **GWP-f**=Global Warming Potential fossil fuels (GWP-fossil) | **GWP-b**=Global Warming Potential biogenic (GWP-biogenic) | **GWP-luluc**=Global Warming Potential land use and land use change (GWP-luluc) | **ODP**=Depletion potential of the stratosperic ozon layer (ODP) | **AP**=Acidification potential, Accumulated Exceedance (AP) | **EP-fw**=Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater) | **EP-m**=Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine) | **EP-T**=Eutrophication potential, Accumulated Exceedance (EP-terrestrial) | **POCP**=Formation potential of tropospheric ozone (POCP) | **ADP-mm**=Abiotic depletion potential for non fossil resources (ADP mm) | **ADP-f**=Abiotic depletion for fossil resources potential (ADP fossil) | **WDP**=Water (user) deprication potential, deprivation-weighted water consumption (WDP)

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS EN 15804+A2

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PM	disease incidence	7.51E-5	2.03E-6	4.57E-6	8.17E-5	5.33E-6	2.92E-6	0.00E+0	7.68E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.24E-7	1.15E-7	1.71E-6	6.01E-8	-2.52E-5
IR	kBq U235 eq.	2.23E+1	2.00E-1	1.89E+1	4.14E+1	4.05E-1	1.29E+0	0.00E+0	1.11E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.78E-3	6.53E-3	5.19E-1	1.03E-2	1.24E-1
ETP-fw	CTUe	8.18E+3	1.92E+2	4.53E+2	8.82E+3	3.86E+2	2.99E+2	0.00E+0	1.16E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.01E+0	1.23E+1	1.63E+2	9.02E+1	9.70E+2
HTP-c	CTUh	1.67E-6	1.25E-8	1.78E-7	1.86E-6	2.92E-8	1.01E-7	0.00E+0	1.46E-9	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.52E-10	6.19E-10	1.90E-8	4.11E-10	-3.22E-7
HTP-nc	CTUh	2.43E-5	2.76E-7	8.87E-7	2.54E-5	6.07E-7	8.27E-7	0.00E+0	2.97E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.14E-9	1.34E-8	6.78E-7	8.17E-9	-7.20E-6

PM=Potential incidence of disease due to PM emissions (PM) | **IR**=Potential Human exposure efficiency relative to U235 (IRP) | **ETP-fw**=Potential Comparative Toxic Unit for ecosystems (ETP-fw) | **HTP-c**=Potential Comparative Toxic Unit for humans (HTP-c) | **HTP-nc**=Potential Comparative Toxic Unit for humans (HTP-nc) | **SQP**=Potential soil quality idex (SQP)

5 Results

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
SQP	Pt	3.22E+3	2.35E+2	5.25E+3	8.71E+3	5.88E+2	2.99E+2	0.00E+0	5.68E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.38E-1	1.32E+1	1.72E+2	1.47E+1	-4.04E+2

PM=Potential incidence of disease due to PM emissions (PM) | **IR**=Potential Human exposure efficiency relative to U235 (IRP) | **ETP-fw**=Potential Comparative Toxic Unit for ecosystems (ETP-fw) | **HTP-c**=Potential Comparative Toxic Unit for humans (HTP-c) | **HTP-nc**=Potential Comparative Toxic Unit for humans (HTP-nc) | **SQP**=Potential soil quality idex (SQP)

CLASSIFICATION OF DISCLAIMERS TO THE DECLARATION OF CORE AND ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

ILCD classification	Indicator	Disclaimer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
ILCD type / level 2	Acidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – 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.

Disclaimer 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 experienced with the indicator.

5 Results

5.2 INDICATORS DESCRIBING RESOURCE USE AND ENVIRONMENTAL INFORMATION BASED ON LIFE CYCLE INVENTORY (LCI)

PARAMETERS DESCRIBING RESOURCE USE

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PERE	MJ	1.37E+3	6.11E+0	9.34E+2	2.31E+3	1.24E+1	7.09E+1	0.00E+0	2.68E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.74E-2	2.37E-1	2.18E+1	4.01E-1	-3.13E+2
PERM	MJ	0.00E+0	0.00E+0	1.82E+2	1.82E+2	0.00E+0	5.46E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	MJ	1.37E+3	6.11E+0	1.12E+3	2.49E+3	1.24E+1	7.64E+1	0.00E+0	2.68E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.74E-2	2.37E-1	2.18E+1	4.01E-1	-3.13E+2
PENRE	MJ	1.16E+4	3.89E+2	2.60E+3	1.46E+4	7.85E+2	4.89E+2	0.00E+0	3.76E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.41E+0	1.68E+1	1.97E+2	8.64E+0	-2.42E+3
PENRM	MJ	4.71E+2	0.00E+0	4.88E+1	5.20E+2	0.00E+0	1.56E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.16E+1
PENRT	MJ	1.21E+4	3.89E+2	2.65E+3	1.51E+4	7.85E+2	5.05E+2	0.00E+0	3.76E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.41E+0	1.68E+1	1.97E+2	8.64E+0	-2.43E+3
SM	Kg	7.43E+1	0.00E+0	2.97E+0	7.72E+1	0.00E+0	2.32E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	m^3	8.73E+0	5.60E-2	1.37E+0	1.02E+1	1.18E-1	3.23E-1	0.00E+0	2.50E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.00E-4	4.04E-3	1.11E-1	7.59E-3	7.24E-2

PERE=Use of renewable primary energy excluding renewable primary energy resources used as raw materials | **PERM**=Use of renewable primary energy resources used as raw materials | **PERT**=Total use of renewable primary energy resources | **PENRE**=Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials | **PENRM**=Use of non-renewable primary energy resources used as raw materials | **PENRT**=Total use of non-renewable primary energy resources | **SM**=Use of secondary material | **RSF**=Use of renewable secondary fuels | **NRSF**=Use of non-renewable secondary fuels | **FW**=Net use of fresh water

OTHER ENVIRONMENTAL INFORMATION DESCRIBING WASTE CATEGORIES

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD	Kg	5.16E-1	2.47E-3	8.04E-2	5.99E-1	4.94E-3	3.44E-2	0.00E+0	4.57E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.52E-4	1.07E-4	5.64E-1	3.49E-5	6.57E-1
NHWD	Kg	2.54E+2	1.93E+1	1.26E+1	2.86E+2	4.94E+1	3.61E+1	0.00E+0	2.19E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.76E-2	1.11E+0	1.19E+1	2.39E+1	-4.64E+1
RWD	Kg	1.64E-2	1.33E-4	2.39E-2	4.05E-2	2.63E-4	1.26E-3	0.00E+0	8.72E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.08E-6	3.83E-6	3.94E-4	6.47E-6	4.83E-5

HWD=Hazardous waste disposed | **NHWD**=Non-hazardous waste disposed | **RWD**=Radioactive waste disposed

5 Results

ENVIRONMENTAL INFORMATION DESCRIBING OUTPUT FLOWS

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
CRU	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	Kg	0.00E+0	0.00E+0	3.91E+0	3.91E+0	0.00E+0	3.09E+0	0.00E+0	1.80E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.69E+1	0.00E+0	1.11E+0
MER	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EET	MJ	0.00E+0	0.00E+0	4.61E-1	4.61E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.21E+1
EEE	MJ	0.00E+0	0.00E+0	2.67E-1	2.67E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.45E+1

CRU=Components for re-use | **MFR**=Materials for recycling | **MER**=Materials for energy recovery | **EET**=Exported Energy, Thermic | **EEE**=Exported Energy, Electric

5 Results

5.3 INFORMATION ON BIOGENIC CARBON CONTENT PER PIECE

BIOGENIC CARBON CONTENT

The following Information describes the biogenic carbon content in (the main parts of) the product at the factory gate per piece:

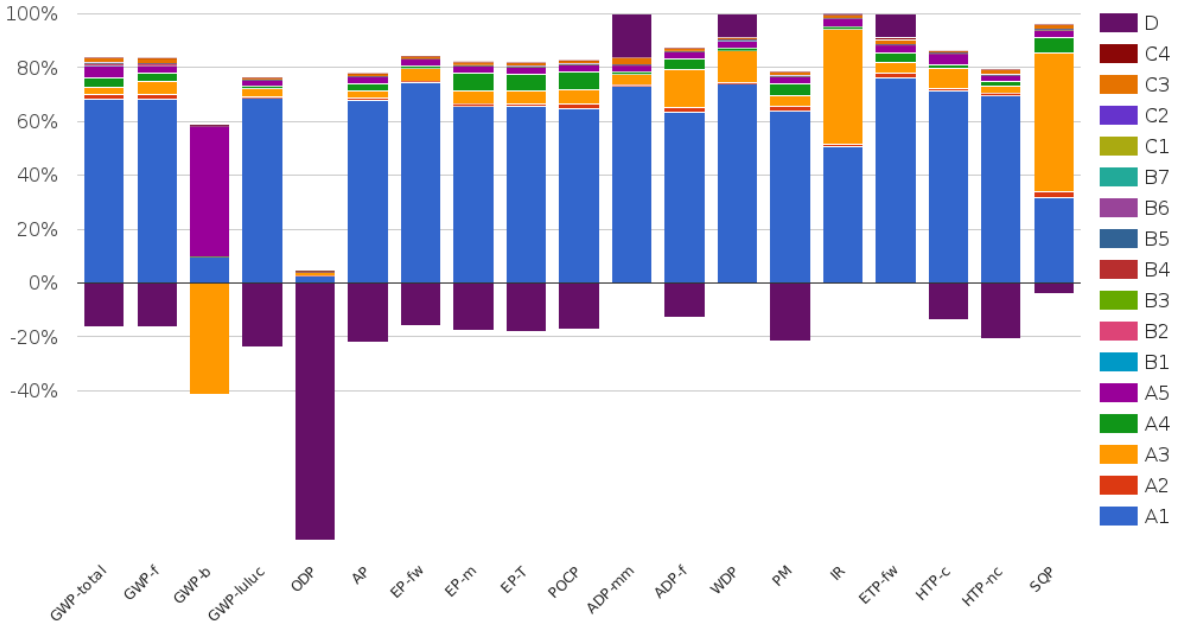
Biogenic carbon content	Amount	Unit
Biogenic carbon content in the product	0	kg C
Biogenic carbon content in accompanying packaging	5.91	kg C

UPTAKE OF BIOGENIC CARBON DIOXIDE

The following amount of carbon dioxide uptake is taken into account. Related uptake and release of carbon dioxide in downstream processes are not taken into account in this number although they do appear in the presented results. One kilogram of biogenic Carbon content is equivalent to 44/12 kg of biogenic carbon dioxide uptake.

Uptake Biogenic Carbon dioxide	Amount	Unit
Packaging	21.67	kg CO2 (biogenic)

6 Interpretation of results



The contribution of the various modules considered in the LCA study is presented in the graph for 1 piece of the product Elbow T 155-7g. Modules A1 (raw material supply) and A3 (manufacture) emerge as the most significant contributors to all assessed indicators.

The contribution of raw materials (A1) is significantly high, whereas other modules contribute a relatively minor impact. Module A3 shows a significant negative impact for GWP-b potentially due to the high biogenic content of the packaging material.

For most indicators, Module D indicates environmental benefits or credit reflecting benefits from recycling or energy recovery beyond the system boundary. It does however, show small impact for ADP-mm, WDP and ETP-fw.

7 References

ISO 14040
ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework; EN ISO 14040:2006

ISO 14044
ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines; EN ISO 14044:2006

ISO 14025
ISO 14025:2011-10, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804+A2
EN 15804:2012+A2:2019/AC:2021, Sustainability of Buildings - Environmental Product Declarations - Framework Development Rules by Product Category

EN 50693
Product category rules for life cycle assessments of electronic and electrical products and systems

EPDItaly007
Core Product Category Rules based on EN 50693 for electrical and electronic products Rev. 3.1 (2024-11-12)

Kiwa-EE GPI R.2.0
Kiwa-Ecobility Experts, General Programme Instructions “Product Level”, SOP EE 1203_R. 2.0 (27.02.2025)

Kiwa-EE GPI R.2.0 Annex B1
Kiwa-Ecobility Experts, General Programme Instructions “Product Level” – Annex B1 Environmental Information Programme according to EN 15804 / ISO 21930, SOP EE 1203_R. 2.0 (27.02.2025)

Ecoinvent
ecoinvent Version 3.9.1 (December 2022)

R<THINK characterization method
ecoinvent 3.9.1: EN 15804+A1 indicators (CML-IA Baseline v3.09), EN 15804+A2 indicators (EF 3.1)

IEC TS 62271-320:2025
High-voltage switchgear and controlgear - Part 320: Environmental aspects and life cycle assessment rules for high-voltage switchgear and controlgear

PEFCRs
Product Environmental Footprint Category Rules (PEFCRs)for Products in building, 2019

7 References

IEC/TR 62635
Guidelines for end-of-life information provided by manufacturers and recyclers and for recyclability rate calculation of electrical and electronic equipment.

8 Contact information

Publisher	Operator	Owner of declaration
Kiwa-Ecobility Experts Wattstraße 11-13 13355 Berlin, DE	**Kiwa-Ecobility Experts** Wattstraße 11-13 13355 Berlin, DE	**Grid Solutions** 167 QUAI de la bataille de stalingrad 92130 Issy-les-Moulineaux , FR
E-mail: DE.Ecobility.Experts@kiwa.com	**E-mail:** DE.Ecobility.Experts@kiwa.com	**E-mail:** Solene.Michaud@gevernova.com
Website: https://www.kiwa.com/de/en/themes/ecobility-experts/ecobility-experts-epd-program/	**Website:** https://www.kiwa.com/de/en/themes/ecobility-experts/ecobility-experts-epd-program/	**Website:** www.gevernova.com/grid-solutions

Kiwa-Ecobility Experts is established member of the ECO PLATFORM