PFISTERER

ENVIRONMENTAL PRODUCT DECLARATION

In compliance with ISO 14025 and EN 50693:2019

Insulator GSCC010/01 and Insulator GSCC010/08

Site Plant: DALIAN CTC INSULATOR COMPANY LIMITED. 32 Guangyuan Street, Lvshun Economic Development Zone, Dalian, 116052, China

Program operator	EPDItaly
Publisher	EPDItaly
Declaration number	0102
Registration number	EPDITALY0504
Issue date	27/10/2023
Valid to	27/10/2028

GENERAL INFORMATION

EPD owner	PFISTERER SRL Società Unipersonale Via Filippo Turati 28 20026 Novate Milanese (MI), Italy it.pfisterer.com
Production site	DALIAN CTC INSULATOR COMPANY LIMITED. 32 Guangyuan Street, Lvshun Economic Development Zone, Dalian, 116052, China
Reference product	Composite insulator GSCC010/01 and composite insulator GSCC010/08 marketed by Pfisterer Srl
Program operator	EPDItaly https://www.epditaly.it/; info@epditaly.it
Third-party verification	Independent verification of the declaration and data, in compliance with ISO 14025:2010. ☐ Internal ☒ External Verification conducted by: IMQ SpA, Via Marco Fabio Quintiliano, 43, 20138 – Milano (www.imq.it). (Certification Body accredited by Accredia)
CPC Code	46211 – "Electrical apparatus for switching or protecting electrical circuits, for making connections to or in electrical circuits, for a voltage exceeding 1000 V"
Reference PCR	Core-PCR EPDItaly007 "Electronic and electrical products and systems", rev. 3, 2023/01/13 [PCR Committee: ICMQ S.p.A. – Via G. De Castillia, 10. Eng. Elena Neri, Indaco2. Moderator: Ing. Ugo Pannuti, ICMQ Spa] Sub-PCR EPDItaly012 "Insulators" REV. 0 – 2020/03/16 [PCR Committee: CESI S.p.A., ECAMRICERT, Take Care International, ENEL S.p.A.]
Other reference documents	Regulation of the EPDItaly Programme – rev. 5.2 EN 50693:2019 "Product category rules for life cycle assessments of electronic and electrical products and systems".
Company contact	Dora Giustiniano (Dora.Giustiniano@pfisterer.com)
Study developed by	Valentina Castellani, Sustainability consultant
Declaration of responsibility	The owner of the declaration will be responsible for the information and supporting evidence. EPDItaly disclaims any liability regarding the manufacturer's information data.
Comparability	EPDs relating to the same category of products but belonging to different programmes may not be comparable.
Type of the EPD	Product EPD

COMPANY INFORMATION

The two insulators object of this EPD are produced by CTC Insulator Co in China and marketed by Pfisterer s.r.l all around the World.

CTC Insulator Co., Ltd. is a manufacturer of composite insulators and bushings. Starting in 2002 and becoming an LLC in 2016, CTC Insulator has more than 100 employees with approximate annual sales of 60 million CNY (9.4 million USD).

Pfisterer S.r.l. Italy is part of the Pfisterer group. The PFISTERER corporate group is a German-Swiss family-run company with a worldwide network of production sites and sales offices. It develops, produces, and sells components and complete solutions for highly sensitive interfaces in modern power networks.

The company was founded in 1921 by Karl Pfisterer, who wanted to improve electrical fittings. In the era of electrification, users frequently encountered problems with the metallic elements used to connect lines. And this is precisely where "Karl Pfisterer, Fabrik elektrotechnischer Spezialartikel" (Karl Pfisterer's factory for special electro-technical articles), founded in the Untertürkheim district of Stuttgart in 1921, came in. The goal was to develop solutions and new products for the interfaces between energy networks. As one of the few companies of its type on the global market, PFISTERER offers solutions for the entire transmission chain for low, medium, high, and extra-high voltage.

The PFISTERER corporate group has been dealing with the interfaces in the flow of electricity ever since it was founded back in 1921. Efficient contact technology for high-current lines and reliable voltage insulation – PFISTERER's core skills form the basis for a wide spectrum of services in the field of insulator strings, cable solutions, and contact systems. PFISTERER products are used in areas such as power grids and rail catenary systems for electric railways. The connection components are also used in industrial power units and energy supply systems.

LIFE CYCLE ASSESSMENT INFORMATION

The company undertook the LCA study having as main goal to obtain EPDItaly certification of the environmental impact generated by the product during its life cycle, to be communicated to its clients. Other potential uses of the study include the identification of hotspots in the product life cycle, in support to the definition of improvement measures, and the monitoring of results over time.

The scope of the EPD is "from cradle to grave". However, in compliance with EPDItaly PCR010 "Insulators" the installation phase and the use phase have been cut-off from the inventory analysis.

The modules and activities included in the EPD are illustrated in Table 3, according to EN 50639:2019.

Table 1 – Modules included in the EPD

Manufacturing		Distribution	Installation	Use & Maintenance	End-of-Life
Upstream module	Core module	Downstream module			
Production of raw materials Transportation of raw materials the manufacturing site	Injection molding of silicone rubber Assembly of the insulator Testing Product packaging	Transport of product to the site of installation	(Cut-off)	(Cut-off)	De-installation of product and EoL of product materials

Geographical scope: the geographical scope of the study is China for the Manufacturing phase and Brasil for the downstream module.

Temporal scope: The temporal scope of the study is 2022-2023, and the following 20 years assumed as service life of the product (starting from the year of production and installation, i.e. 2023). The temporal scope associated to the inventory data collected is 2022, which is the last calendar year for which a full set of records regarding electricity, natural gas and water use was available at the time of the study.

Database and LCA software used: the LCI of the system has been modelled in SimaPro software, version 9.5, using ecoinvent 3.9.1 LCI library.

Cut-off and exclusions: Following the PCR EPDItaly 007, the following flows and operation has been cut-off: Production, use and disposal of the packaging of components and semi-finished intermediates; General waste generated at the production site; Materials and energy flows related to the dismantling phase, because it is assumed that it is performed by adopting manual tools. In addition, cut-off is applied to Installation and Use phase, as indicated by EPDItaly PCR010 – Insulators.

Allocation: Allocation procedures have been adopted for estimating the consumption of water for one unit of each product analyzed, based on the total mass of products produced by CTC in the reference year (2022) and the total consumption of water in the same period.

Declared unit: a single insulator which insulates a current-carrying element from another element during a service life of 20 years.

System boundary: see description of production process and inventory assumptions and scenarios.

PRODUCT SYSTEMS ANALYZED

The product systems analyzed correspond to two composite insulators: GSCC010/01, which is a long-rod insulator, and GCC010/08, which belongs to the line-post insulators family. Both products are used for distribution and high voltage transmission lines.

The products have been designed jointly by Pfisterer and CTC with reference to the specifications requested by the final client.

The expected lifetime of the products is 20 years. Main technical specifications of the switches analyzed are detailed in Table 2.

Table 2 – Technical specifications of insulator GSCC010/01 and insulator GSCC010/08

Property	Unit	GSCC010/01	GSCC010/08
Maximum system voltage	kV	24	24
Min. Creepage distance	Mm	900	745
Min. Dry arcing distance	mm	330	250
Lightning impulse withstand voltage(p):	kV	125	125
Power frequency withstand voltage (wet)	kV	50	50
Specified cantilever load (SCL)	kN	-	10
Max. Design cantilever load (MDCL)	kN	-	5
Specified mechanical load (SML)	kN	70	-
Reference standard	-	IEC 61109	IEC 61952

The following table illustrate the material content of the two insulators. The products are compliant to the requirements of the European directive "2011/65/EU ROHS 2 - Restriction of dangerous substances in electrical and electronical equipment".

Table 3 – Material content

Material		GSCC010/01		GSCC010/08	
		kg	%	kg	%
Metals	Steel	0.755	*53.7%*	0.5	*14.6%*
	Iron	-		1.67	*48.7%*
Plastics	Glass fiber	0.17	*12.1%*	0.48	*14.0%*
	Silicone rubber	0.48	*34.2%*	0.78	*22.7%*
	Total	**1.40**	*100%*	**3.43**	*100%*

PRODUCTION PROCESS AND INVENTORY ANALYSIS

The study is cradle-to-grave, i.e. it includes all the life cycle phases of the product under investigation, from the extraction of raw materials to the dismantling and End of Life (EoL) of the product, with the exception of installation and use phase that have been cut-off following the EPDitaly PCR 010.

The life cycle phases of the system under study are illustrated in Figure 1.

Figure 1 – Life cycle of insulators GSCC010/01 and GSCC010/08

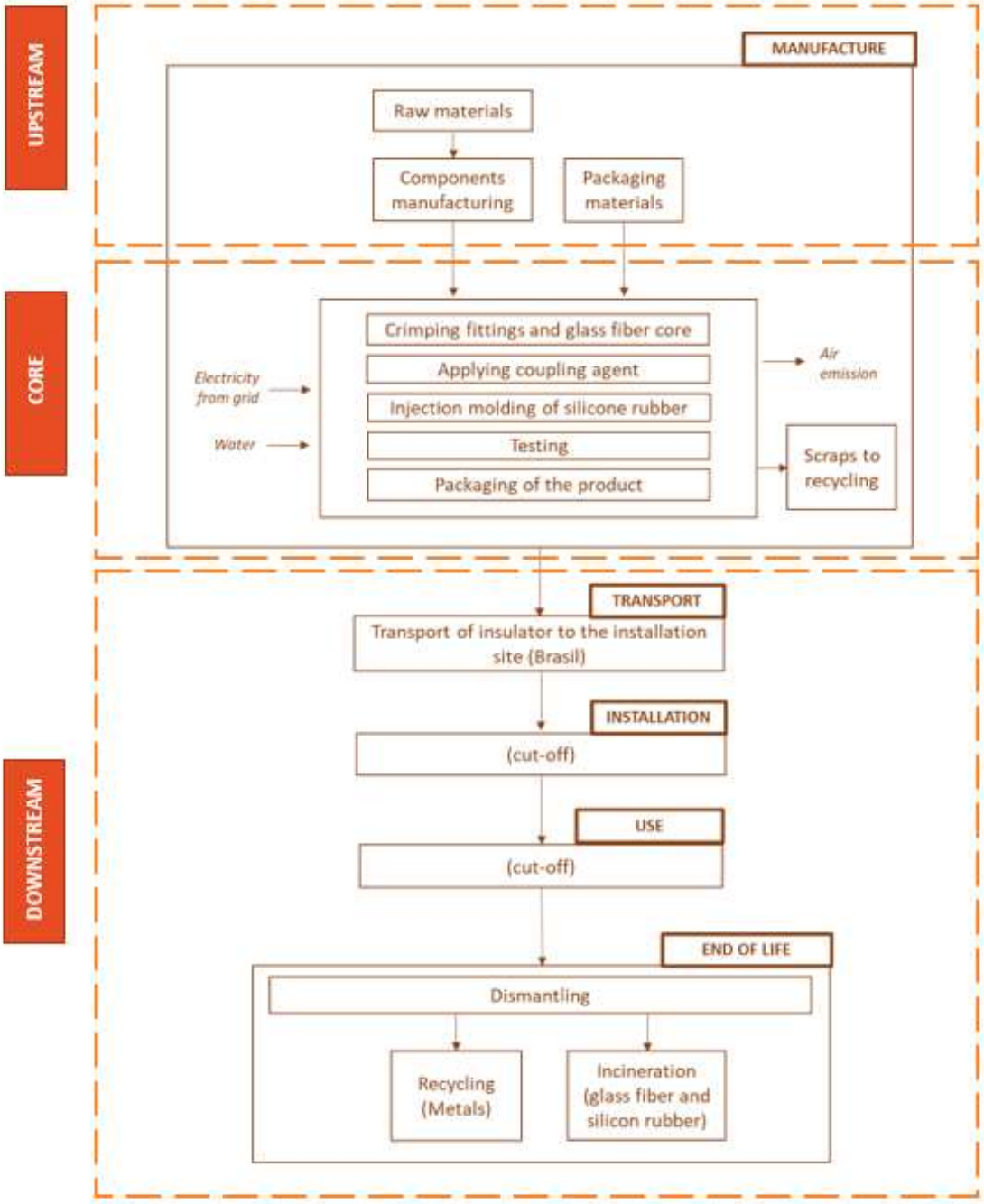

Table 4 – Main characteristics of the inventory analysis

Life cycle stage	Description and assumptions
Upstream	Manufacture of components is modelled based on project documents (materials and weight, including scraps) and considering the transport distance from the supplier to CTC production site in Dalian city (China).
Core	The core phase includes the use of electricity and water, the transport of scraps (3% of silicone rubber used in the products) to a recycling facility where silicon oil is recovered and the treatment of the wastewater generated during the process. Water use associated to the production of one unit of each product has been estimated through allocation by mass of the total consumption of the plant in the reference year (2022) to the total mass of products manufactured in the same period.
Distribution	The insulators are transported from Dalian city in China to the port of San Poalo (Santos) in Brasil. The distribution scenario includes the transport by truck from Dalian city to Dalian port and the transport by container ship from Dalian port to Santos port.
Installation	(cut-off)
Use and maintenance	(cut-off)
End of Life (EoL)	The EoL scenario for the materials in the insulators assumes recycling of metals and incineration of glass fiber and silicone rubber components.

ENVIRONMENTAL PERFORMANCE

The following tables report the results of environmental indicators, resource use indicators, and waste production indicators, expressed with reference to the declared unit of the study (D.U.), i.e. one piece of insulator with a service life of 20 years, for the three products analyzed.

Table 5. Results of indicators describing environmental impacts per D.U. of GSCC010/01

		Upstream	Core		Downstream							
Impact category	**Unit**	**Manufacturing**			**Distribution**		**Installation**		**Use and maintenance**		**EoL**	
Climate change	kg CO2 eq	6.41E+00	2.92E+00	*79%*	3.57E-01	*3%*	N.A.	-	N.A.	-	2.15E+00	*18%*
Climate change - Fossil	kg CO2 eq	6.51E+00	2.94E+00	*80%*	3.56E-01	*3%*	N.A.	-	N.A.	-	1.95E+00	*17%*
Climate change - Biogenic	kg CO2 eq	-1.04E-01	-1.67E-02	*-166%*	-5.01E-05	*0%*	N.A.	-	N.A.	-	1.94E-01	*266%*
Climate change - Land use and LU change	kg CO2 eq	7.77E-03	6.86E-04	*95%*	2.78E-04	*3%*	N.A.	-	N.A.	-	1.31E-04	*1%*
Ozone depletion	kg CFC11 eq	2.20E-04	4.78E-09	*100%*	5.29E-09	*0%*	N.A.	-	N.A.	-	2.45E-09	*0%*
Acidification	mol H+ eq	3.45E-02	1.47E-02	*82%*	1.04E-02	*17%*	N.A.	-	N.A.	-	4.70E-04	*1%*
Eutrophication, freshwater	kg P eq	1.87E-03	5.67E-04	*99%*	1.17E-05	*0%*	N.A.	-	N.A.	-	8.17E-06	*0%*
Photochemical ozone formation	kg NMVOCeq	2.54E-02	9.13E-03	*81%*	7.74E-03	*18%*	N.A.	-	N.A.	-	5.69E-04	*1%*
Resource use, minerals and metals	kg Sb eq	2.59E-05	7.84E-06	*98%*	3.42E-07	*1%*	N.A.	-	N.A.	-	1.87E-07	*1%*
Resource use, fossils	MJ	7.46E+01	2.59E+01	*95%*	4.29E+00	*4%*	N.A.	-	N.A.	-	7.31E-01	*1%*
Water use	m3 depriv.	6.88E-02	2.78E-01	*78%*	9.99E-03	*2%*	N.A.	-	N.A.	-	8.78E-02	*20%*

Table 6. Results of indicators describing environmental impacts per D.U. of GSCC010/08

		Upstream	Core		Downstream							
Impact category	**Unit**	**Manufacturing**			**Distribution**		**Installation**		**Use and maintenance**		**EoL**	
Climate change	kg CO2 eq	1.68E+01	3.42E+00	*81%*	8.26E-01	*3%*	N.A.	-	N.A.	-	4.05E+00	*16%*
Climate change - Fossil	kg CO2 eq	1.66E+01	3.43E+00	*82%*	8.26E-01	*3%*	N.A.	-	N.A.	-	3.69E+00	*15%*
Climate change - Biogenic	kg CO2 eq	1.50E-01	-1.93E-02	*27%*	-1.16E-04	*0%*	N.A.	-	N.A.	-	3.56E-01	*73%*
Climate change - Land use and LU change	kg CO2 eq	1.88E-02	8.05E-04	*95%*	6.45E-04	*3%*	N.A.	-	N.A.	-	3.31E-04	*2%*
Ozone depletion	kg CFC11 eq	3.59E-04	5.93E-09	*100%*	1.23E-08	*0%*	N.A.	-	N.A.	-	5.03E-09	*0%*
Acidification	mol H+ eq	1.08E-01	1.72E-02	*83%*	2.40E-02	*16%*	N.A.	-	N.A.	-	1.02E-03	*1%*
Eutrophication, freshwater	kg P eq	7.02E-03	6.66E-04	*99%*	2.72E-05	*0%*	N.A.	-	N.A.	-	1.73E-05	*0%*
Photochemical ozone formation	kg NMVOCeq	6.93E-02	1.07E-02	*81%*	1.79E-02	*18%*	N.A.	-	N.A.	-	1.27E-03	*1%*
Resource use, minerals and metals	kg Sb eq	3.91E-04	9.17E-06	*100%*	7.92E-07	*0%*	N.A.	-	N.A.	-	4.24E-07	*0%*
Resource use, fossils	MJ	1.87E+02	3.03E+01	*95%*	9.93E+00	*4%*	N.A.	-	N.A.	-	1.72E+00	*1%*
Water use	m3 depriv.	1.16E+00	2.79E-01	*88%*	2.31E-02	*1%*	N.A.	-	N.A.	-	1.67E-01	*10%*

Table 8. Results of parameters describing resource use, referred to the D.U. of GSCC010/01

Indicator	Unit	Total	Manufacturing		Distribution	Installation	Use and Maintenance	EoL
			Upstream	Core	Downstream			
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material (PENRE)	MJ	**8.14E+01**	5.12E+01	2.59E+01	4.29E+00	N.A.	N.A.	7.32E-01
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	MJ	**8.74E+00**	7.05E+00	1.66E+00	3.05E-02	N.A.	N.A.	1.98E-02
Use of non-renewable primary energy resources used as raw material (PENRM)	MJ	**2.34E+01**	2.34E+01	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00
Use of renewable primary energy resources used as raw material (PERM)	MJ	**3.61E+00**	3.61E+00	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT)	MJ	**1.05E+02**	7.46E+01	2.59E+01	4.29E+00	N.A.	N.A.	7.32E-01
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT)	MJ	**1.24E+01**	1.07E+01	1.66E+00	3.05E-02	N.A.	N.A.	1.98E-02
Net use of fresh water (FW)	m^3	**2.54E-02**	1.84E-02	6.73E-03	2.38E-04	N.A.	N.A.	2.56E-03
Use of secondary materials (MS)	kg	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00
Use of renewable secondary fuels (RSF)	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00
Use of non-renewable secondary fuels (NRSF)	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00

Table 9. Results of parameters describing resource use, referred to the D.U. of GSCC010/08

Indicator	Unit	Total	Manufacturing		Distribution	Installation	Use and Maintenance	EoL
			Upstream	Core	Downstream			
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material (PENRE)	MJ	**1.86E+02**	1.46E+02	3.03E+01	9.93E+00	N.A.	N.A.	1.72E+00
Use of renewable primary energy excluding renewable primary energy resources used as raw material (PERE)	MJ	**2.01E+01**	1.81E+01	1.93E+00	7.07E-02	N.A.	N.A.	4.22E-02
Use of non-renewable primary energy resources used as raw material (PENRM)	MJ	**4.16E+01**	4.16E+01	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00
Use of renewable primary energy resources used as raw material (PERM)	MJ	**5.57E+00**	5.57E+00	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT)	MJ	**2.28E+02**	1.87E+02	3.03E+01	9.93E+00	N.A.	N.A.	1.72E+00
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT)	MJ	**2.57E+01**	2.37E+01	1.93E+00	7.07E-02	N.A.	N.A.	4.22E-02
Net use of fresh water (FW)	m^3	**6.66E-02**	5.92E-02	6.80E-03	5.51E-04	N.A.	N.A.	4.95E-03
Use of secondary materials (MS)	kg	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00
Use of renewable secondary fuels (RSF)	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00
Use of non-renewable secondary fuels (NRSF)	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00

Table 11. Results of waste production descriptive parameters, referred to the D.U. of GSCC010/01

Indicator	Unit	Total	Manufacturing		Distribution	Installation	Use and Maintenance	EoL
			Upstream	Core	Downstream			
Hazardous waste disposed (HWD)	kg	**2.41E-04**	2.08E-04	1.16E-05	2.13E-05	N.A.	N.A.	5.17E-06
Non-hazardous waste disposed (NHWD)	kg	**3.64E+00**	3.40E+00	2.31E-01	1.27E-02	N.A.	N.A.	8.87E-02
Radioactive waste disposed (RWD)	kg	**9.22E-05**	7.86E-05	1.32E-05	4.73E-07	N.A.	N.A.	2.75E-07
Materials for energy recovery (MER)	kg	**6.50E-01**	0.00E+00	0.00E+00	0.00E+00	N.A.	N.A.	6.50E-01
Material for recycling (MFR)	kg	**1.37E+00**	0.00E+00	4.80E-01	0.00E+00	N.A.	N.A.	8.92E-01
Components for reuse (CRU)	kg	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00
Exported thermal energy (ETE)	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00
Exported electricity energy (EEE)	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00

Table 12. Results of waste production descriptive parameters, referred to the D.U. of GSCC010/08

Indicator	Unit	Total	Manufacturing		Distribution	Installation	Use and Maintenance	EoL
			Upstream	Core	Downstream			
Hazardous waste disposed (HWD)	kg	**7.86E-04**	7.22E-04	1.39E-05	4.93E-05	N.A.	N.A.	1.18E-05
Non-hazardous waste disposed (NHWD)	kg	**6.56E+00**	6.26E+00	2.72E-01	2.94E-02	N.A.	N.A.	1.87E-01
Radioactive waste disposed (RWD)	kg	**2.15E-04**	1.98E-04	1.54E-05	1.10E-06	N.A.	N.A.	5.93E-07
Materials for energy recovery (MER)	kg	**1.26E+00**	0.00E+00	0.00E+00	0.00E+00	N.A.	N.A.	1.26E+00
Material for recycling (MFR)	kg	**3.39E+00**	0.00E+00	7.80E-01	0.00E+00	N.A.	N.A.	2.61E+00
Components for reuse (CRU)	kg	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00
Exported thermal energy (ETE)	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00
Exported electricity energy (EEE)	MJ	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	N.A.	N.A.	0.00E+00

REFERENCES

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7. Core-PCR EPDItaly007 "Electronic and electrical products and systems", rev. 3, 2023/01/13.
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